The Electrical Industry's Weekly Magazine

February 13, 1961

Electrical World

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A McGraw-Hill Publication

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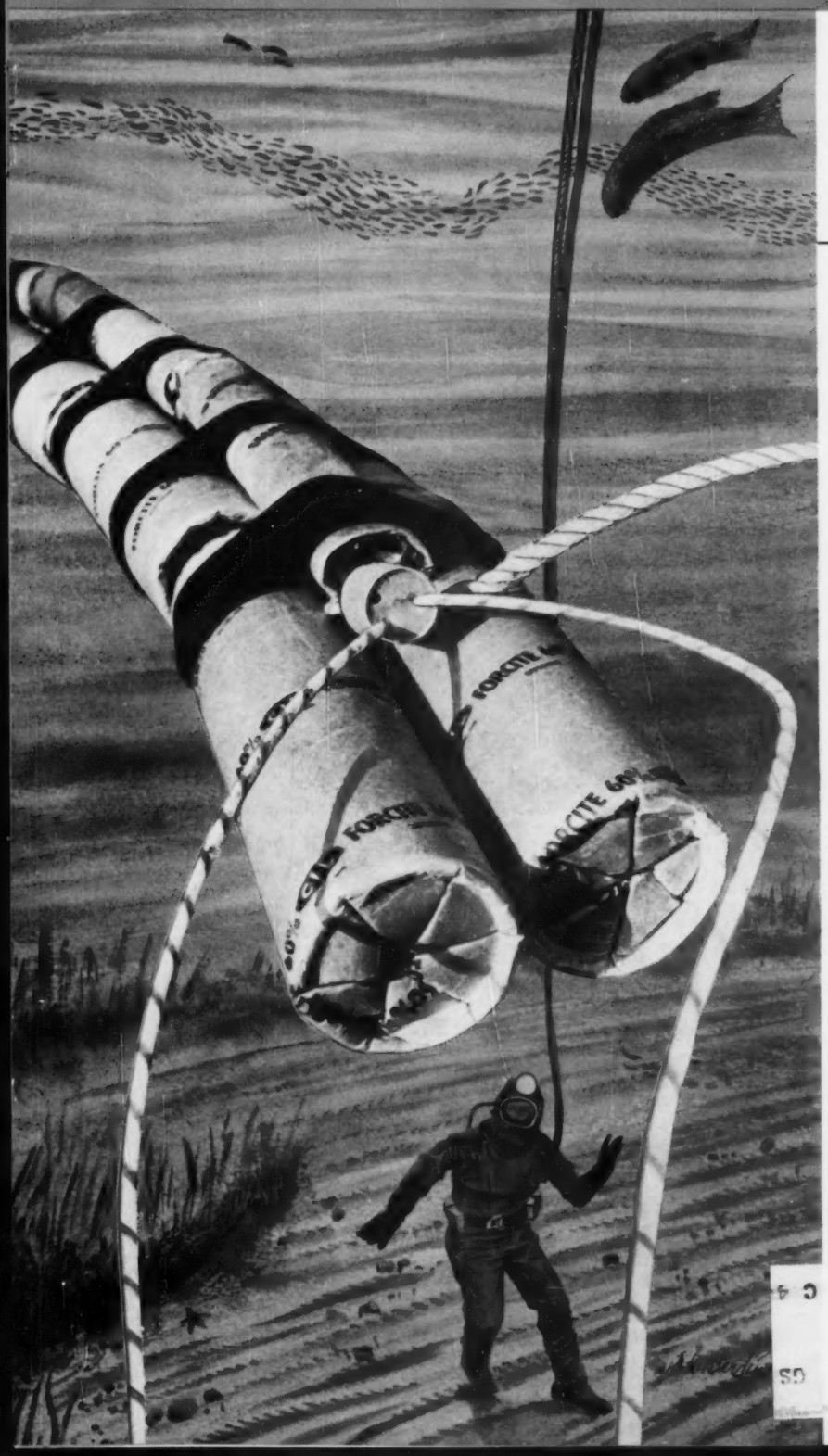

Starts on p 71

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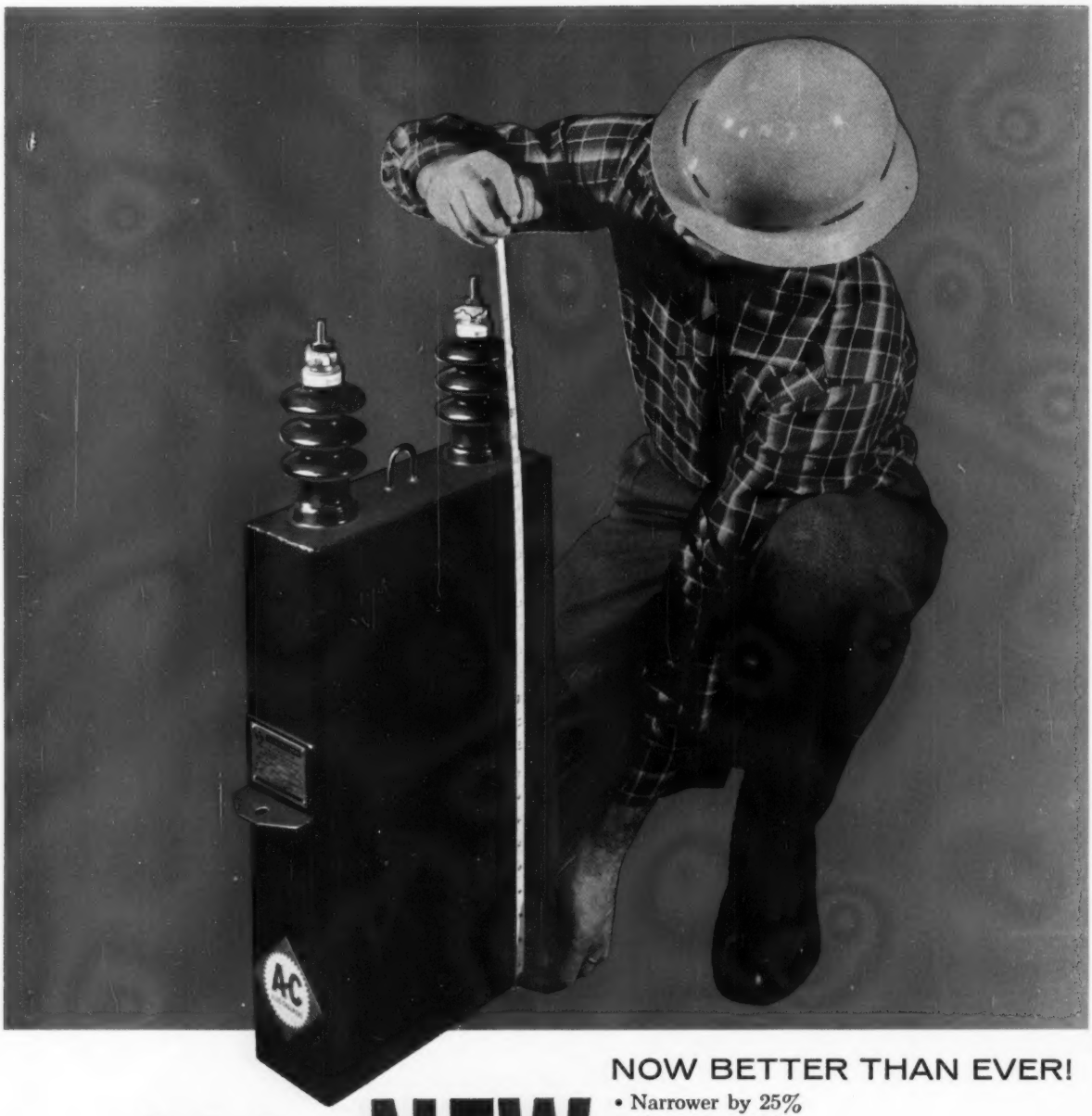

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Electrical World

FEBRUARY 13, 1961

Vol. 155, No. 7

Electrical What in the World . . .

Every power man is concerned about the poor impression student engineers have of utility work as a rewarding profession. There's a moot question as to whether progress is being made in correcting this impression.

A sharp illustration of what still goes on came to our attention recently. Upon reading of the new Rorden bare-hand live-line maintenance technique (EW, Dec. 19, p 76), a highly respected engineering university provost wrote that ". . . the new technique shows that there is still opportunity for creative contributions in the power field."

This provost, an EE, is known for his electronics work. We're quite sure he meant what he wrote in all seriousness, without tongue in cheek and without sarcasm. This makes his comment all the more biting.

We take nothing away from the Rorden technique; we happen to think it will have far-reaching effects. But there are so many other exciting things, so many "opportunities for creative contributions," in utility engineering that we're frankly baffled by the dean's statement. The serious aspect is that this man has great power to steer his students toward or away from utilities.

Electrical World long has felt strongly about the situation, but editorializing and preaching does little good. We're growing more convinced we should start heavier coverage of engineering education affairs. At the very least, publicity on the market for prospective utility engineers would help to alert the overall industry to status and trends.

Chuck Hochgesang

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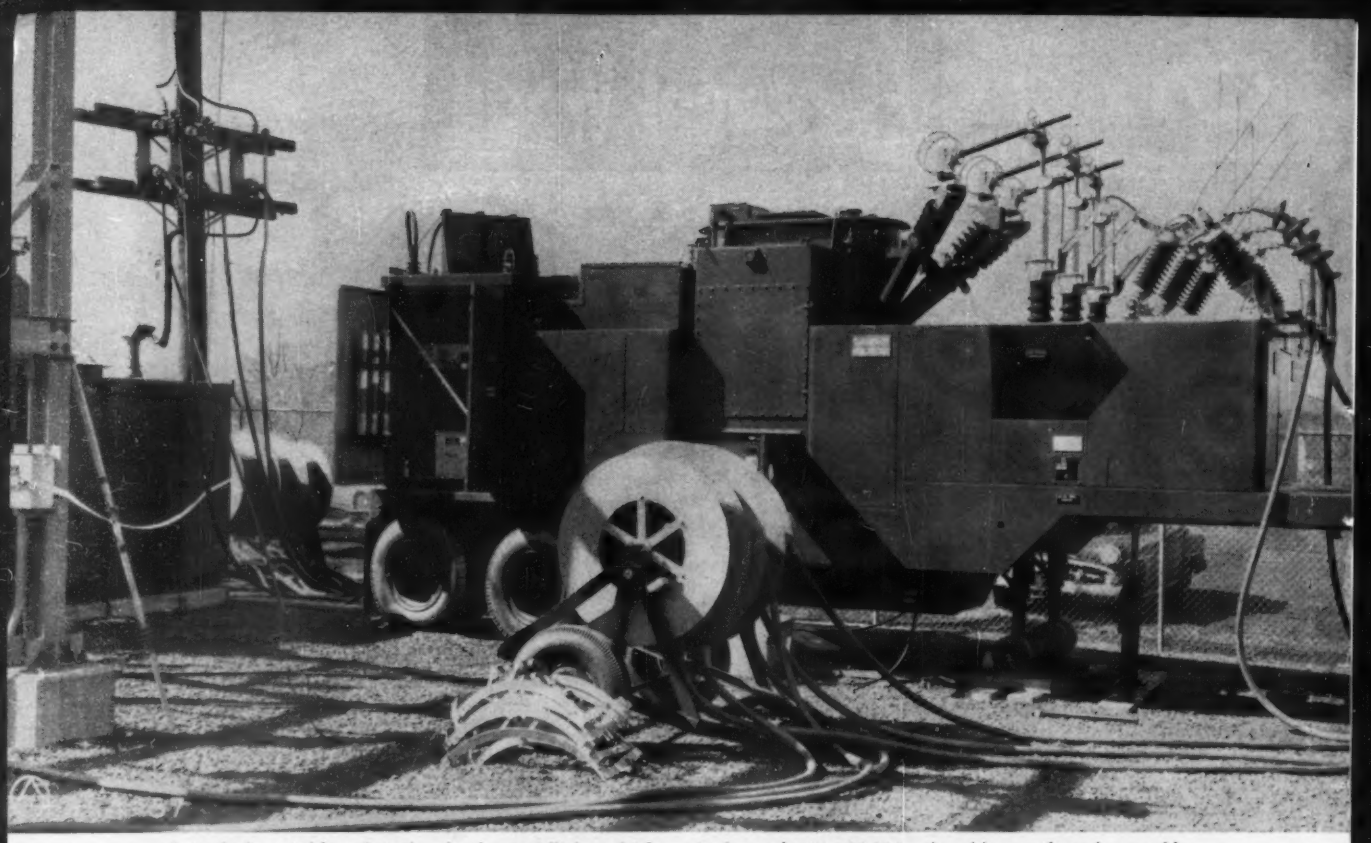
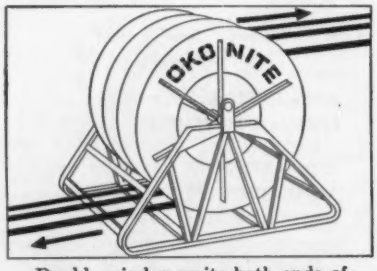


A typical portable substation hook-up utilizing single conductors as recommended by Okonite for portable substation use. Three single-conductor, 5000-volt Okonite substation cables are shown in left background; three single-conductor, 27,000-volt cables on the primary side are in foreground. The three single conductors for each voltage are wound bifilarly on Okonite-designed sectional reels which permit unreeling in two directions at once.

You can reduce substation cutting-in time to minutes by using Okonite-engineered portable cable assemblies

Okonite mobile substation cables provide a compact and functional package engineered to speed up emergency or stand-by substation hook-ups. Cutting in the mobile substation can literally be done in minutes rather than the hours needed with conventional reels, on-the-spot terminations and awkward, heavy cable constructions.

Needed lengths, with permanent factory-molded terminations to fit the customer's needs, are shipped on Okonite-designed reels equipped with clamping devices for the cable terminations and a stand to permit letoff and takeup. Additional features which make this unit fast and easy-operating are a gear drive and a special double-ended winding method, called *bifilar*, which permit both ends of each of three cables to be withdrawn simultaneously. The reel is merely placed at the center of the run and only the required length of cable need be unwound.



Double wind permits both ends of cable to be let off simultaneously.

Designed and built to your needs and specifications, Okonite mobile substation cable and reel assemblies are one more interesting example of Okonite Cable'bility.*

For more information that will give you totally new ideas on speed and efficiency when tying in mobile substations, ask your Okonite representative or write to The Okonite Company, Subsidiary of Kennecott Copper Corporation, Passaic, N. J.

*OKONITE Cable'bility . . . cable craftsmanship since 1878

***where there's electrical power . . . there's* OKONITE CABLE**

6266-A

Letters

Engineers Can Speak Out

To the Editor:

Your comments concerning engineers needing to be more effective public speakers in the editorial, "Only Engineers Can Build Their Own Public Image," (EW, Dec. 12, 1960) was read with interest. This item is especially timely as National Engineers Week is Feb. 19 through Feb. 25. This nationally proclaimed week allows engineers to toot their own horn to captive audiences at various civic clubs and other meetings.

As an engineer who has been interested in public speaking since high school days, I would like to recommend very highly "Toastmasters" organizations to fellow engineers who would like to improve their speaking ability.

There are four "Toastmasters" clubs in Bartlesville (Okla.) and many of the members are engineers. We are called upon to make talks many times during the year. The local chapter of the Oklahoma Society of Professional Engineers calls upon us each year during National Engineers Week to give talks on engineering subjects to most of the local civic clubs. This practice helps us as public speakers and also as engineers.

Thanks for calling attention in your fine publication to an often overlooked but important phase of engineering work.

W. Don Buckner, P. E.
1902 Johnstone Place
Bartlesville, Okla.

Where Is the Output Map?

To the Editor:

Last week I was co-winner in our company's peak generation contest, largely as a result of referring to your "Weekly Power Output Chart." I've often wondered what a map would look like with the geographical breakdown for each of the regions listed with your output chart. Would you print one nearby, say once a year. . . .

Ralph R. Blanchard, P. E.
Jackson, Mich.

▶ Such a map is available in EEI and FPC publications, but thanks for the idea.

Dateline . . .

Nashville —Joseph Charles Swidler, 54, is a quiet-spoken, pipe-smoking Nashville lawyer whose devotion to the Tennessee Valley Authority and public power has spanned about half his life.

Now President Kennedy has appointed him chairman of the Federal Power Commission.

And in this new position Swidler will be launching what he calls "a new career" but one closely tied to the regulation of giant hydroelectric power projects and interstate electricity across the country.

It was almost 22 years ago when Swidler and a fellow lawyer, J. A. (Cap) Krug, negotiated a contract with Wendell Willkie which opened up the Tennessee Valley to cheap TVA power.

Willkie, later an unsuccessful Republican candidate for President, was chairman of the Commonwealth & Southern Corp, a holding company which owned the old Tennessee, Alabama, and Georgia electric power companies.

David Lilienthal, then chairman of the TVA board, had failed to reach an agreement with Willkie on the sale of transmission lines and electric facilities of Tennessee Electric Power Co to TVA and various municipalities and cooperatives in the state.

After deadlock-breaking talks with Swidler and Krug, who was later secretary of commerce, Willkie signed the contract on May 12, 1939, and TVA

(*Continued on page* 53)

ELECTRICAL WORLD
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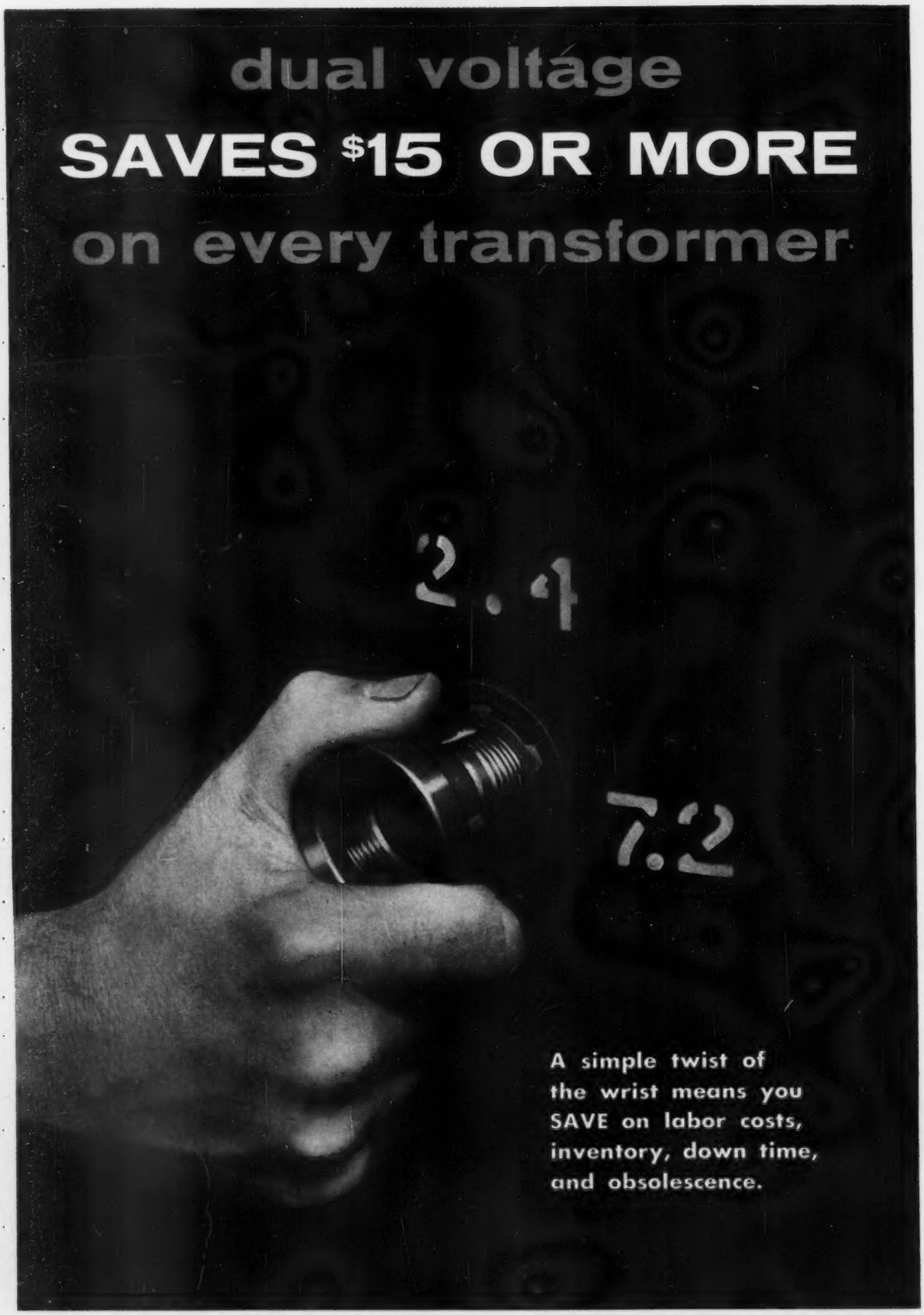
dual voltage
SAVES $15 OR MORE
on every transformer



A simple twist of
the wrist means you
SAVE on labor costs,
inventory, down time,
and obsolescence.

SAVE ON LABOR COSTS

Change voltage with a twist of the externally mounted switch . . . no connection changes *inside* the transformer tank are necessary. Keyed handle assures correct switch positioning, everytime. This simple operation means only one transformer needed on the pole before and after cutover . . . a big savings in labor costs!

SAVE ON INVENTORY

Increasing system voltages the RT&E dual-voltage way, means you buy and store fewer new units . . . less capital is tied up in new transformers. Dual-voltage transformers are versatile . . . can be used on both old and new voltages. Less inventory means more storage space for other equipment, more efficient use of warehouse space.

SAVE ON DOWN TIME

With dual-voltage transformers in operation, large areas can be cutover to higher voltage in far less time. Interruption of customer service is very short making for good customer relations. Less down time means cutover crews are released faster.

SAVE ON OBSOLESCENCE

Installing dual units in future cutover areas reduces the number of lower voltage transformers purchased. Units that are taken down can be used for parts of the system that will not be uprated. This saves money in obsolescence of the lower voltage transformers.

plan to save . . . plan for the future . . .

use RT&E *Dual-Voltage Transformers!*

Since R T & E introduced the industry's first externally operable dual-voltage transformers in 1955, a constantly increasing number of leading utilities have planned for the future by using the R T & E dual-voltage system. Case histories show economies realized in labor, inventory, down time, and obsolescence well in excess of $15 for each transformer installed.

To see how these savings can be computed, ask your R T & E representative, or write, for the R T & E bulletin entitled, **"Distribution System Conversion to Higher Voltage Using Dual-Voltage Transformers."**

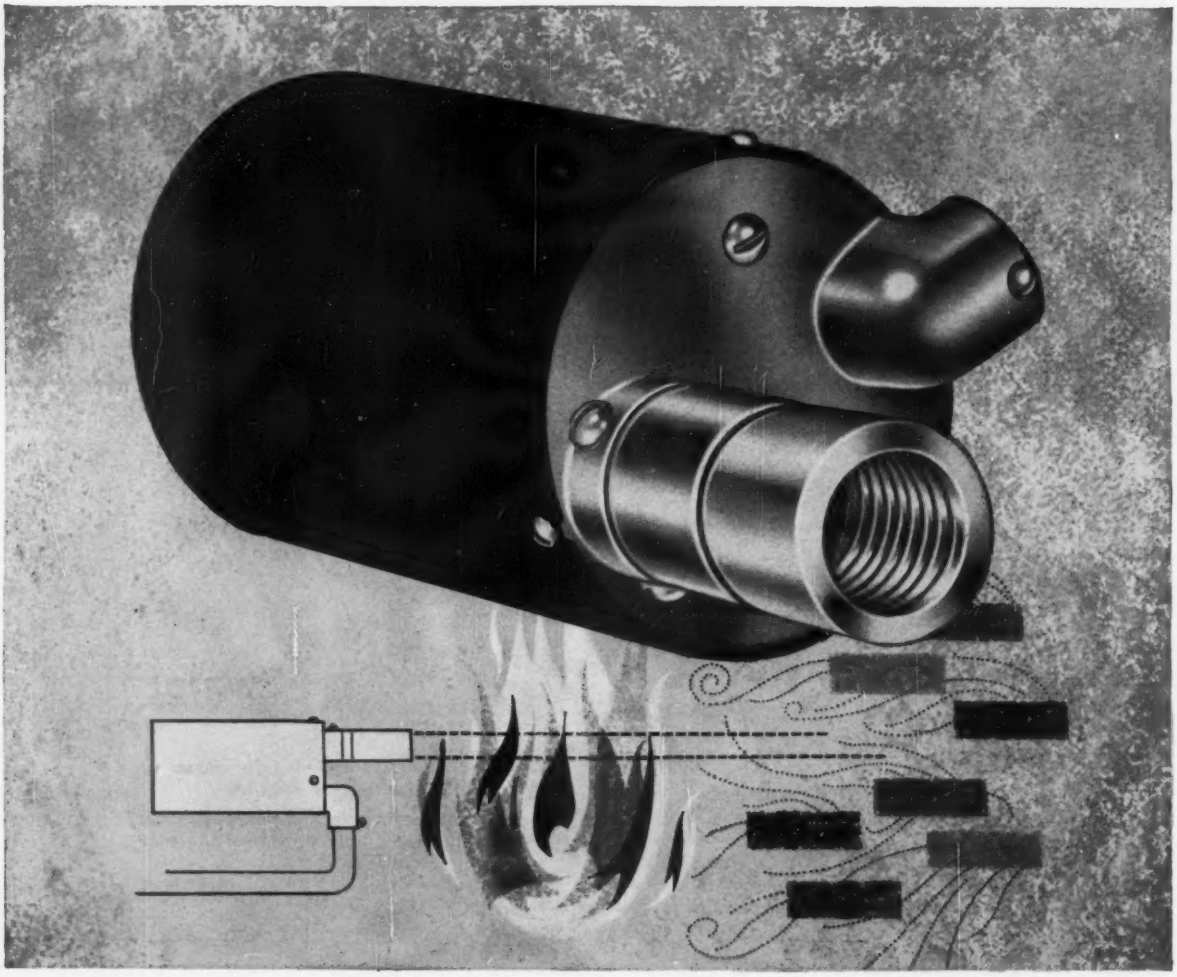
RT&E CORPORATION

WAUKESHA, WISCONSIN • PORTLAND, OREGON • ARLINGTON, TEXAS

Dual Voltage Transformers are a result of Engineering Talent Concentration on One Idea — A Better Transformer.

Undetected flame failure can cause costly interruptions, do serious damage to expensive equipment and endanger lives. To prevent such loss, Honeywell has developed an ultraviolet flame detector that won't be fooled, because it positively differentiates between flame and hot brick.

This flame detector



Now, for the first time, you can be absolutely sure that fuel delivery will be stopped in the absence of flame. Honeywell's new C7012A Ultra-Vision* Flame Detector employs an amplified ultraviolet signal to positively distinguish between an actual flame (ultraviolet rays) and a hot refractory (infrared rays). This revolutionary new ultraviolet sensor represents a major breakthrough in scientific flame detection.

Because this compact new control device is not sensitive to a hot refractory, flame supervision of both single and multiple burners is simplified. The Ultra-Vision Flame Detector can be aimed at each individual flame in the most convenient way. It is the only device on the market that offers you this advantage.

Best of all, this new flame detector saves you money. Wiring is less expensive in this system than in a lead sulphide cell. It is easier to install because hot refractory can be ignored. And there is no further need for flame rod replacement.

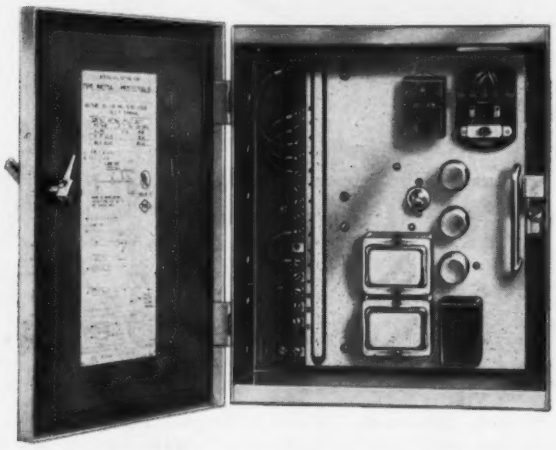
senses only the flame!

New Honeywell Protectoglo relay assures "maximum safety"

Available for use with the Ultra-Vision Flame Detector or with standard flame rods is Honeywell's famous R4075 Protectoglo* relay.

This new relay features "maximum-safety" self-checking which is particularly desirable for continuously burning industrial burners. A self-checking circuit checks the circuit and the components of the Protectoglo *once every second.*

The mounting cabinet of the Protectoglo has all-voltage terminals and a quick-disconnect control base that enables you to remove the relay without disconnecting any of the wiring. Plug-in components can easily be removed and replaced if necessary.



In addition, flame-rod assemblies are available to meet every industrial application. Alarm contacts can be powered from separate line or low-voltage circuit. And a special zinc dichromate finish resists the corrosive effects of most industrial atmospheres.

*Trademark

Honeywell protects Los Angeles' new $65,000,000 power plant

Los Angeles' Department of Power and Water installed the Honeywell Ultra-Vision Flame Detector and Protectoglo System to insure maximum flame safeguard protection for its new Scattergood Steam Plant. This huge power facility covers a 57-acre ocean front site south of the Playa del Rey district of Los Angeles.

The plant now uses two 91-foot-long turbine generators to produce 320,000 kilowatts of power. When the entire complement of six generators is put into operation, the anticipated output will be 1,200,000 kilowatts.

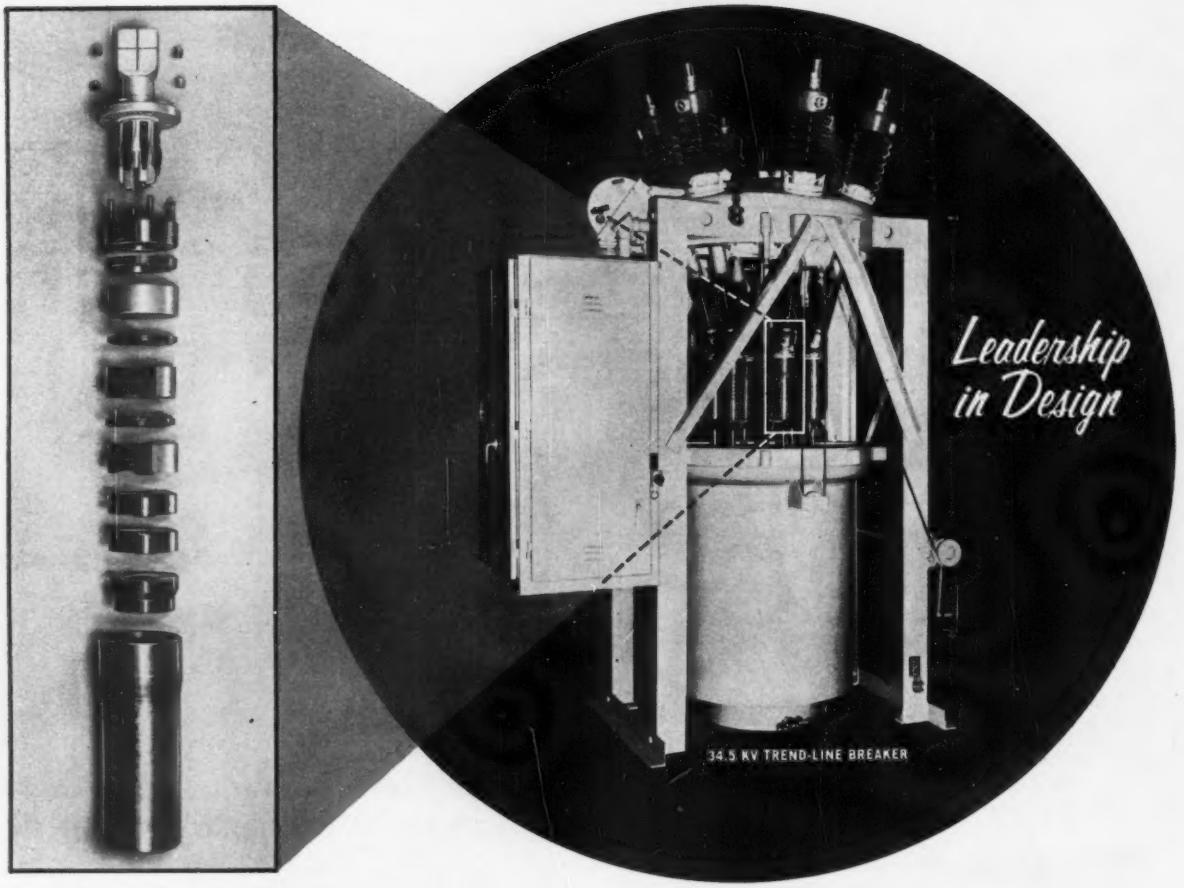
Gas, oil or a combination of both fire the Scattergood boilers. Gas consumption under full load is approximately 1,520,000 cubic feet per hour, and oil is used at 250 barrels an hour. Boilers are 133 feet high and furnace volume is 65,000 cubic feet.

For full information about Honeywell Flame Safeguard Control Systems, call your nearby Honeywell office. Or write Honeywell, Dept. ET2-23, Minneapolis 8, Minnesota. In Canada, write Honeywell Controls, Limited, Toronto 17, Ontario.

Honeywell

First in Control

SINCE 1885



I-T-E FIRSTS...
IN POWER CIRCUIT BREAKER DESIGN

Fiberglas tubes...advanced KOOL-ARC interrupters...TREND-LINE breakers... are proven contributions to a better product for the industry

Although the economy of the industry may fluctuate greatly, I-T-E holds the line on product quality . . . works hard to maintain leadership in power circuit breaker design.

First in this country to introduce the all-fiberglas tube, I-T-E reduced the size of its standard interrupter while increasing tube strength and providing better internal clearances in the breaker. From there, I-T-E engineers moved ahead to develop the new KOOL-ARC design. The KOOL-ARC interrupter then led to the development and introduction of the much heralded, single-tank TREND-LINE breakers, now field-proven and available in subtransmission ratings.

The KOOL-ARC interrupter incorporates simple design and offers easy maintenance. It can be removed from the breaker as a unit and be readily disassembled and assembled in the field by maintenance personnel. KOOL-ARC improvements include not only the keying of all internal parts for simple, rapid field assembly, but also the selection of better materials and processes throughout, such as the use of molded polyethylene rather than fiber for splitter plates. Through this kind of meticulous attention to product detail, I-T-E maintains its leadership in design . . . holds high industry's confidence in the I-T-E product.

For descriptive literature, write the Power Circuit Breaker Division, 1667 N. Main Street, Los Angeles, stating the ratings in which you are interested. Address Dept. EWO-1454-1.

I-T-E CIRCUIT BREAKER COMPANY

WHITE WATER and CREATIVE POWER

On Baker River in the State of Washington, Stone & Webster Engineering Corporation recently completed the design and construction of a multi-unit project for Puget Sound Power & Light Company. The new Upper Baker Plant will peak at over 100,000 kw, while a new generating unit adds 70,000 kw to the existing Lower Baker Plant.

Full, automatic control of the new plant from Lower Baker, eight miles away is made possible by installation of a microwave and supervisory system. Unique facilities for handling migrant fish include elevators, artificial spawning beds and barges on which mechanical turbulence attracts fingerling salmon for safe passage down through the dam.

Stone & Webster engineers can be counted on to provide the creative touch that makes every new project a true advance in power engineering. We would welcome an opportunity to explain in detail how we can serve you.

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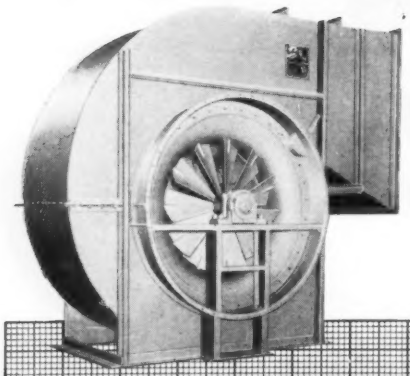
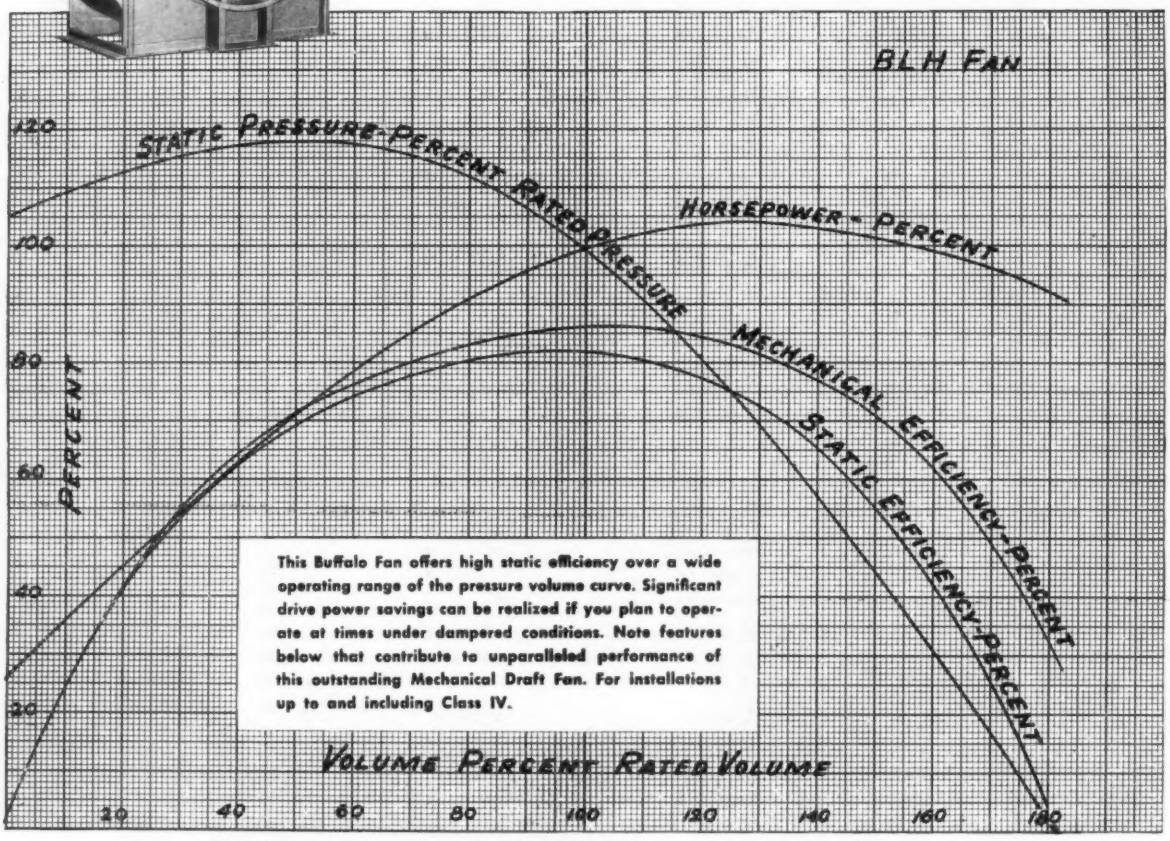


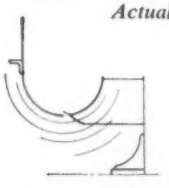
MAXIMUM EFFICIENCY

OVER BROAD OPERATING RANGE

THAT'S THE BUFFALO "BLH"

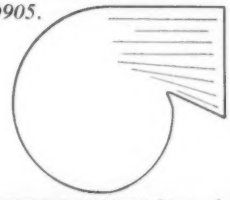


Actual performance curve of Type "BLH" Fan. Write for Bulletin FD905.



EFFICIENCY AT INLET. Cross-section of inlet shows smooth passage into wheel formed by curved inlet bell and mating wheel flange. No flat spots to cause turbulence. Fixed or variable inlet vanes available (without reducing efficiency).

EFFICIENCY IN THE WHEEL. Showing deep, **backward curve** of blades in "BLH" wheel for smooth, quiet handling of air spun into the wheel in the direction of rotation. No waste turbulence.



EFFICIENCY THRU THE HOUSING. Not only is the "BLH" housing streamlined throughout, but its unique divergent outlet delivers air to duct with easy, gradual enlargement for best distribution and static conversion.

"Buffalo"

BUFFALO FORGE COMPANY

BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Buffalo air handling equipment to move, heat, cool, dehumidify and clean air and other gases.

Buffalo Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

Buffalo Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

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MODEL AIDS DESIGN of Glen Canyon power features.

LATE NEWS ▶ **Prime prospect for new REA administrator is Norman Clapp,** brother of former TVA Chairman, Gordon Clapp. Recently active in Wisconsin REA activities, Norman Clapp was an unsuccessful Democratic Congressional candidate in Wisconsin last November. Sen William Proxmire (D-Wis.) is a strong supporter. Meanwhile, John A. Baker, agricultural credit services director, is acting REA administrator.

Atom items—Dispute between US Marine Corps and SoCalEd over site of proposed 360-Mw reactor may kill the project. SoCalEd claims Camp Pendleton site is the only feasible one; USMC refuses to allow use of its land. AEC, anxious to keep project alive, says SoCalEd plans four nuclear units on this site eventually. . . . **N. Y. State Office of Atomic Energy turns down** request by Power Authority of State of New York for authority and aid to build a nuclear power plant. State OAE also urges AEC to evaluate new in-city cite proposed by Jamestown, N. Y., for 16.5-Mw reactor and, if site is unsatisfactory, to consider modifying design.

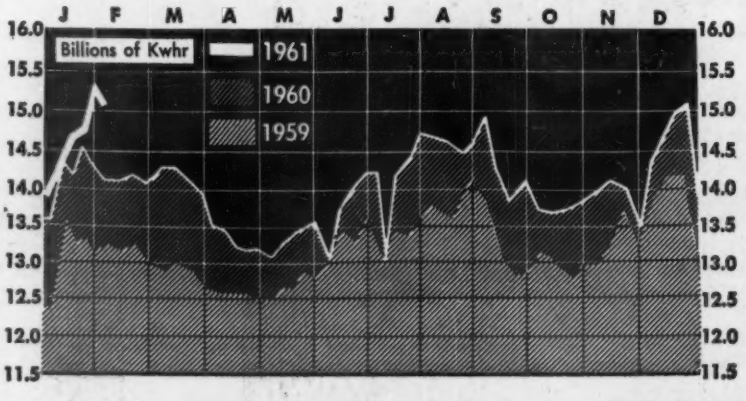
Three proposed standards for EHV transmission voltages are undergoing ratification by members of ASA Section Committee C-92 on Insulation Coordination and EHV. The three nominal and maximum voltage recommended are: 345/362 kv; 500/525 kv; and 700/735 kv. If the ballots are favorable, the recommendation will go through the regular ASA procedure for adoption as a national standard.

FPC Chairman Kuykendall turns thumbs down on Interior Secretary Udall's request for return of BPA load estimates for Pacific Northwest circulated by Interior Department in last days of Eisenhower Administration. Estimates show Columbia River treaty would obviate both Nez Perce and High Mountain Sheep. Kuykendall claims return would be inappropriate and that Udall can still make new estimates . . . **Udall also asks re-examination of 230-kv tie between Colorado and western Missouri** basins, via Pueblo and Limon, Colo., and pledges speed-up in building federal transmission for Upper Colorado Project.

SEC okays Middle South Utilities' stock option plan for its executives. Sale price must be 100% of market value on date of issue. Not more than 25% of the 120,000 shares involved can be optioned to executives employed at time plan is adopted. No executive can buy shares exceeding 150% of his regular annual salary.

A 30-year interconnection pact for transmitting 150 Mw over 138 miles of new 345-kv transmission line has been signed by Indianapolis P&L and AEP's Indiana & Michigan Electric.

WEEKLY POWER OUTPUT—Up 6.1% (Week ending Feb. 4), Kwhr 15,072,000,000



Per Cent Change From Previous Year

	Jan. 21	Jan. 28	Feb. 4
Total U. S.	+ 1.3	+ 6.5	+ 6.1
New Eng.	+ 4.7	+10.9	+10.2
Mid. Atlan.....	+ 3.1	+ 8.0	+ 8.6
Cent. Indust. ..	− 4.9	+ 0.2	+ 0.2
West Cent. ...	+ 2.8	+ 8.2	+ 8.5
Southeast	+ 3.8	+10.5	+ 9.6
South Cent. ..	+ 3.9	+ 7.4	+ 5.9
Rocky Mount...	+10.9	+13.3	+13.4
Pacific			
NW	− 3.3	+ 5.6	+ 6.1
SW	+ 6.5	+ 7.3	+ 4.6

Seasonally Adjusted Index 281

Week Ago 281 Year Ago 267

Source: Edison Electric Institute

Supply Lines

TRANSMISSION MARKET UPSURGE HOT TOPIC AT BUYERS MEETING

Upsurge in the market for transmission equipment and materials was one of the hot topics in corridor talk at the utility buyers' group meeting in Detroit last week (see p 54). Some manufacturers of insulators, wire and cable, and other transmission materials reported bustling activity in the form of inquiries, rush requests for bids, and even in orders. One manufacturer reported the busiest January he had ever had. It appeared that the prospective business was coming from investor-owned utilities as well as government agencies.

To manufacturers affected, the renewed interest came somewhat as a surprise. One, whose own forecasts were on the conservative side, said that experience during the first month of the year gave credence to *Electrical World's* report there would be a 28% jump in spending for transmission during the current year.

There were a few whispers about a new twist on the turnkey contract—this one for a sizeable transmission line. It's still in the talking stage. But the proposition has been put to a utility which is planning an interconnection. A manufacturer and a contractor-engineer offered a joint contract. Competitors consider it serious enough to warrant possible counter offers, and smaller product suppliers are hustling about hoping to get in on the act, if the utility decides on turnkey.

Aftermath of the antitrust cases also figured in informal conversations of utility buyers at the Detroit meeting. On top of regular duties, a number of utility purchasing departments are now engaged in comprehensive studies with regard to settlements in the suits. These studies appear to be taking various forms and are guided by top executives and legal departments in the individual utilities.

APPARATUS BUSHING PRICES REDUCED

Price reductions of from 3% to 9% on apparatus bushings have been announced by General Electric Co. The reductions, which were effective Jan. 30, apply to TBI and other ASA bushings rated 23, 34.5, and 69 kv and non-standard bushings rated 69 kv and below. GE says it is now possible to purchase dual-rated interchangeable bushings at the same price as single-rated non-interchangeable bushings. Previous reductions made by GE on TBI and other ASA bushings occurred in September when an average price reduction of 5% was made (EW, Sept. 19, 1960, p 126).

ORDERLY BUYING OF T-G UNITS WILL SAVE UTILITIES MONEY, GE SAYS

Utilities can save more than a quarter of a billion dollars over the next ten years if they buy steam turbine-generators on a regular, rather than cyclic, basis, GE says. The company notes that the Tennessee Valley Authority saved $3,200,000 by accepting shipment in advance of need dates for two 800-Mw units on order. GE also notes it is making a drive to boost turbine-generator exports.

SUMMARY OF CORPORATE ANTITRUST FINES ON NEXT PAGE. STORY ON P 48.. ▶

Summary of Corporate Fines (in thousands of dollars)

PRODUCT GROUP	General Electric	Westinghouse Electric	Allis-Chalmers	Federal Pacific Electric	I-T-E Circuit Breaker	McGraw-Edison	Lapp Insulator	Ohio Brass	Porcelain Insulator	Joslyn	Hubbard	A. B. Chance	Southern States Equip.	H. K. Porter	Maloney Electric	Wagner Electric	Kuhlman Electric	Schwager-Wood	Allen-Bradley	Clark Controller	Cutler-Hammer	Square D	Foster Wheeler	Carrier	Ingersoll-Rand	C. H. Wheeler	Worthington	Sangamo Electric	Cornell-Dubilier
Power Switchgear Assemblies	30	20	10	10	10																								
Oil & Air Circuit Breakers	40	30	20	15	10																								
Low-voltage Power Circuit Breakers	10	5			5																								
Bushings	10	10					5	10																					
Insulators	20				10	10	10	20	7.5			7.5		10															
Open Fuse Cutouts	7.5	10			5	10				5	2.5	10	10																
Lightning Arresters	15	15				10		7.5		10	7.5			10															
Distribution Transformers	30	30	20			25									15	15	10												
Power Transformers	40	40	25			20									15	10													
Instrument Transformers	10	7.5	7.5																										
Network Transformers	15	10	10			5									5	2													
Power Switching Equipment	30	20		15	15					10			20	25				15											
Navy & Marine Switchgear	5	7.5			7.5																								
Isolated Phase Bus	10	7.5			5									5															
Industrial Control Equipment	35	40																	40	25	35	35							
Low-voltage Distribution Equipment	40	35		25	25																10	40							
Turbine-Generators	50	35	25																										
Steam Condensers		25	10																				20	7.5	20	20	20		
Power Capacitors	20	10				15		7.5																				7.5	20
Watthour & Demand Meters	20	15																										10	
TOTAL	437.5	372.5	127.5	65	92.5	95	15	45	7.5	25	10	17.5	30	50	35	27	10	15	40	25	45	75	20	7.5	20	20	20	17.5	20

New lightweight

VAREX®

new Varex is 23% lighter...25% thinner ...and still has the lowest current density

cuts application cost, too!

Capacitors, you've noticed, are getting smaller. With good reason, too!

Smaller dimensions and lighter weight mean easier handling, more convenient installation, lighter racks and lower bending moment on the pole top - - savings all around for buyer and user.

That 25% reduction in thickness illustrated above, for example, brings the length of a 2000-kvar Varex stacking rack down from 168 inches to 132 inches. On the pole top, a 600-kvar Varex in-line equipment shrinks from eight-feet one inch in length to six-feet nine inches. And Varex units still have the lowest over-all height.

Despite these changes, some things *remain unchanged* in the Varex "lightweight 50." Among them is the time-proved principle of extended foil cooling - - the unique design feature that lowers operating temperature and reduces maximum current density to one-fifth that of conventional lightweight units.

Send today for our new four-page catalog-type descriptive brochure, O-B Publication No. 1494-H.

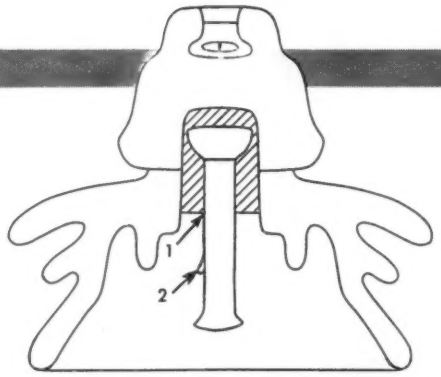
OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

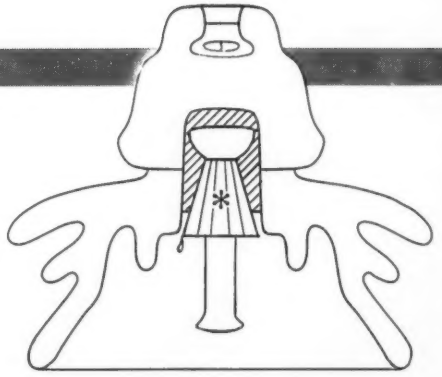
HOLAN

10092-H



Conventional Smogtype suspension insulator

Extra leakage distance offers no protection from corrosive attack on the pin above the cement line (1) or from corrosive attack on the shank (2). Compare this with the sketch at right.



Futura Smogtype suspension insulator

Corrosion Intercepting Sleeve yields slightly as rust products form above cement line, preventing cracking of the porcelain. Sleeve also diverts corrosive salt-water drainage from the pin shank.

specify FUTURA® WITH C.I.S.* to

*CORROSION INTERCEPTING SLEEVE

Conventional Smogtype insulators have only one defense against contamination - - extra leakage distance.

Sometimes, it isn't enough.

To see why, examine the unretouched photograph on the right.

It shows a conventional Smogtype suspension insulator after an extended period of service on a 69-kv line in a heavily contaminated atmosphere - - the "natural habitat," you might say, of all Smogtypes.

Under these conditions, the insulator - - thanks to its 50% greater leakage distance - - protected the line from flashovers - - for a time.

But greater leakage distance, unfortunately, couldn't protect the insulator *itself* from the inevitable by-product of contamination - - *corrosion.*

Moisture, saturated with corrosive salts (dissolved out of surface contaminants), diffused across the underside of the porcelain and across the cement joint to the pin, where the corrosive attack began.

Creeping upward in the cement joint by capillary attraction, the moisture formed rust products (hard as cast iron) between pin and cement - - rust products that expanded in volume until the porcelain cracked.

Drainage down the pin shank fed a simultaneous attack, destroying metal and freezing the clevis connection.

In heavily contaminated "Smogtype" atmospheres, where corrosion hits hardest, you often need *more* than extra leakage distance - - you need *corrosion protection* for the insulator *itself.*

You can get it today, in Smogtypes or non-Smogtypes, by specifying Futura insulators with the exclusive Corrosion Intercepting Sleeve.

Only Futura *protects itself* and your transmission line, too!

10082-H

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

the finest smogtype insulators made today...

lick corrosion

sometimes aren't good enough!
(without C.I.S.*)

O·B Pothead masters high voltage

...Offers quick practical installation ...assures uniform gradient

This 345-kv pothead in Cornell test enjoys same precise installation of vital electrical grading components as all O-B capacitor-graded potheads.

10109-H

Two important factors make the O-B Pothead master of high voltage in terminating underground cables: smooth distribution of line-to-ground voltage and fast, effective installation. Both help insure the exactness needed in a high voltage pothead.

High-magnitude capacitors uniformly grade the electrical stresses in the pothead. These capacitors are positioned over the entire upper end of the cable, making full use of the pothead height. To save field installation time and to assure a factory-quality product, the capacitors are manufactured, installed within the porcelain housing, connected, oil impregnated, and tested . . . all in the factory. They need never be touched in the field. (See photo above)

Even the stress cone offers factory-exactness. O-B wraps the stress cone inside the lower build-up roll by sealing to the paper an aluminum foil strip, perfectly forming a logarithmic curve. No more time-consuming hand-tapering of the build-up; just slip the special stress cone build-up roll over the cable and tighten. It's quick and accurate!

Factory-produced components leave less chance for things to go wrong during installation and establish faithful reproduction of the pothead design.

If you are planning cable installations, ask about O-B's pothead.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass (B) HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

ALLIS-CHALMERS

1. Core nests in base-plate sump.
3. Dropover tank design cuts untanking height and weight.
2. Heavy inside tank bracing eliminates outside stiffeners.
4. Captive-type handhole bolts. No small parts loss.

YOU BET IT'S DIFFERENT ...HERE'S WHY!

Allis-Chalmers engineers re-examined, then redesigned small power transformer mechanical features . . . all to *your* advantage! Check their latest achievements:

1. Easier to handle, move and install. Lower height, center of gravity and weight achieved through a unique base-plate sump that houses the lower section of the core.

2. Repainting simpler — self-cleaning tank reduces maintenance. Internal tank wall bracing eliminates outside debris-catching, rust-prone tank channels.

3. Smaller untanking facilities required. Dropover tank reduces untanking height and weight 50%.

4. Internal inspection quicker and safer. No more dropping manhole cover nuts or bolts into the tank or onto the ground. Only five captive-type nuts and bolts need be loosened to remove cover. Excellent seal and reusability achieved through use of Buna-N gaskets.

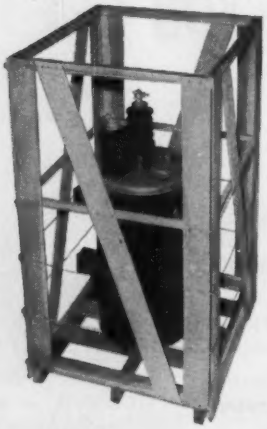
Your nearby A-C office can furnish facts and Bulletin 61C6084B, or write **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wisconsin.* A-1396

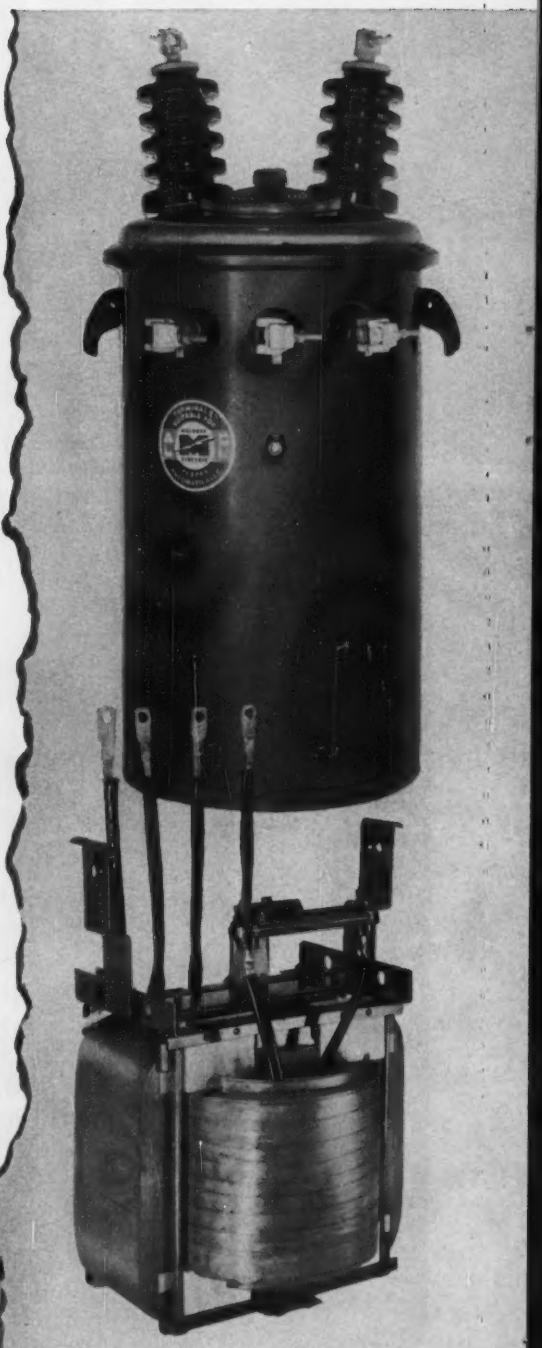
HAVE YOU A NOSE FOR NEWS?

Here's a scoop about the new

MOLONEY

Distribution Transformer





New features have been designed into the New Moloney Distribution Transformers. Compare these new transformers with competitive units. Decide for yourself where you will get the most for your transformer dollar.

NEW DESIGN FEATURES

1. New deep-drawn crowned cover—Smooth, rounded surfaced readily shed moisture and eliminate places where corrosive material can accumulate. The distance from the crown of the cover to the clamping band has been increased. This, when combined with the new Duracoat* Insulation, provides maximum protection against outages due to birds and other wildlife.

2. New cover internally grounded and positioned—(For Duracoat* Covers). A captive phosphor-bronze spring positions and automatically grounds the insulated cover to the tank, to prevent radio-frequency interference and eliminate shock hazards to linemen.

3. New cover clamping band—Designed to exert uniform pressure around the entire circumference of the cover. Clamping is done by a stainless steel bolt whose swinging hinge action permits ready removal of the cover. There is no chance of dropping parts of the clamp since all parts are captive.

4. New moisture shedding weep openings—Numerous weep openings are formed at intervals around the clamping band. These weep openings are so designed that water cannot be trapped in the band.

5. New single bolt handhole cover—Facilitates easy entry into the tank. Uniform pressure is exerted on the corprene sealing gasket by a captive internal bar.

6. New contour lifting hooks—Smoothly contoured hook underside prevents sling abrasion. Designed to permit use of cable or rope slings even on the smallest transformers without damage to bushings.

7. New hercules tank rim—Greater strength for tank top rim is obtained by rolling approximately 400 degrees. This increased resistance to distortion permits retention of the proved Moloney gasketing method.

8. New three-point core-and-coil suspension—Prevents pressure contact of Core-and-coil assembly with the tank bottom and thus achieves a reduction in sound level.

9. New high strength frame design—Maintains the superior eight-point blocking system for resistance to short circuit distortion.

10. New steel banded palletized unit—A steel band connected to the lifting hooks secures the transformer to the shipping pallet and thus facilitates handling by fork lift trucks.

11. New protective enclosure—Pre-tested and proved to be of great strength, the enclosure permits stacking. Easy to strip away when the transformer is to be installed, leaving only the palletized transformer.

PLUS THESE RETAINED SUPERIOR FEATURES

The Superior Moloney Core with inherently low exciting current —low core loss—low sound level • Low impedence design, resulting in improved voltage regulation • High short-circuit strength • High impact strength—liberal creepage bushings • Electro-tin coated connectors large enough to accommodate AL-CU conductors • Triple-thick tank bottom rim • Patented, automatic, electronic testing.

COMPARE COMPARE

So that you may decide for yourself... examine the design of new improvements... review the features which were retained ... compare all of the advantages of Moloney Transformers with competitive units. You will agree that these new improvements—combined with features that have been retained... add up to the best total value for your transformer dollar.

ME61-1

Since 1896... MORE POWER TO YOU

Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

MOLONEY ELECTRIC COMPANY

FACTORIES AT ST. LOUIS 20, MO., AND TORONTO, ONT., CANADA
SALES OFFICES IN ALL PRINCIPAL CITIES

design

simplicity

KPF switches are simple and functional in design. This insures a clean, attractive pole top whether phase units are installed in a triangular, vertical or horizontal configuration.

The simple design of KPF switches also assures operating dependability under all weather conditions. KPF switches have no delicate mechanisms to malfunction, freeze, lock, need lubrication or wear out.

KPF switches have proved themselves in almost 50 years of service on major utilities. Make a test installation. Discover their unique dependability on your own system.

Install in the air—or on the ground

- Top (left)—phase units installed in the air, on previously mounted cross arm.
- Middle—phase units installed on cross arm while on the ground.
- Bottom—phase units and cross arm installed on the ground—pole then tilted into place.

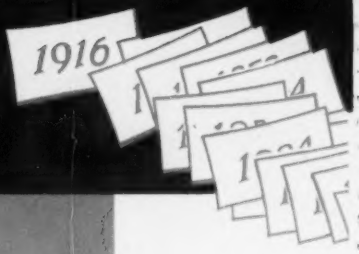
Write direct for catalog

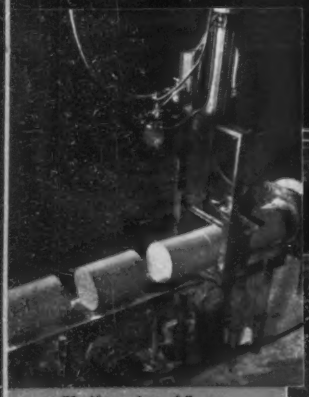
KPF ELECTRIC COMPANY
P.O. Box 1257E
Stockton, California
HOward 4-8381 • Area Code 209

KPF
AIR BREAK SWITCHES
Standard for nearly half a century

Modulus of rupture measurement, a routine laboratory check on strength of porcelain bodies, body-and-glaze combinations and sanded cementing surfaces.

At Lapp, suspension

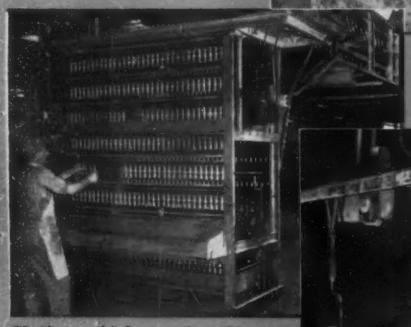




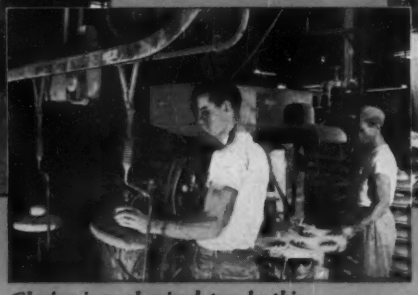
Uniformity of Lapp suspension discs begins with the billets of clay, automatically extruded and sliced to exact size.

Automation all the way! Plunging of lower surfaces of suspension discs is by this automatic machine.

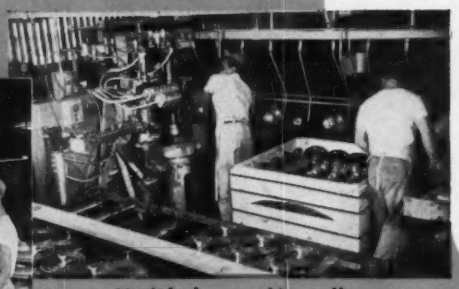
Plunged blanks, their moisture content controlled by an exact temperature-humidity-time cycle, are automatically trimmed to precise size and shape.



Uniform thickness of resilient paint on pins within insulator head is assured by this automatic pin-dipping machine.

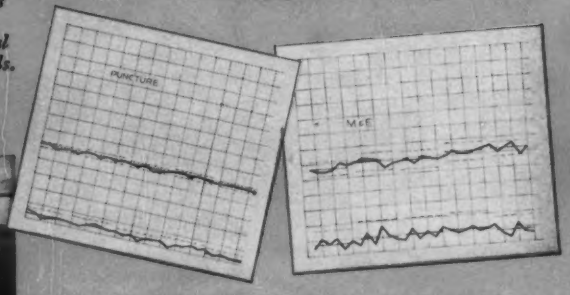


Glazing is mechanized, too, by this machine which glazes insulator shells and applies uniform internal and external sand cementing bands.



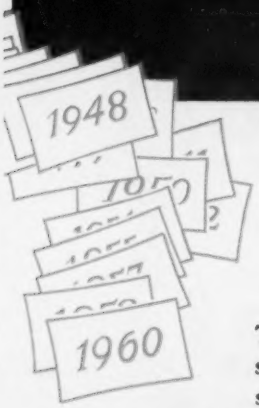
Mutiple-duty machine pulls each insulator at Proof Test Load and trims off surplus cement, paper used under cap.

Every Lapp suspension unit is tested mechanically and electrically. This conveyer carries finished insulators through 60-cycle flashover test for a minimum period of three minutes.



A fixed percentage of production is allocated to quality control testing. Charts like these, of M&E and puncture values, show the continuing improvements in characteristics and uniformity resulting from Lapp production mechanization.

insulator design and production are matters of continuous improvement



we make 'em good...
...and keep making 'em better

Take a look at your last shipment of Lapp suspension insulators. Compare them with some of Lapp's 40-year-old veterans you'll find serving on lines all over the country. You probably won't notice much difference. Yet they're nearly as different as is today's Thunderbird from 1920's Model T.

That's because product improvement is a continuous program with Lapp. We re-design, we test, we prove—and year-by-year we build valid improvements into our insulators and our production processes.

The results? Significant strengthening of every measurable characteristic. Elimination of even the maverick under-strength (and over-strength) individual units. Mechanization of every phase of production, for predictable uniform response to all test standards.

That's the way it is at Lapp. We make 'em good... but we keep making 'em better. And this extra we put into our suspension insulators merits your confidence when you install them, and means extra service after they're up.

Lapp Insulator Co., Inc.,
Le Roy, N. Y.

Lapp

CRESCENT HOT LINE GRIPS

FOR SAFE, REMOTE OPERATION WITH HOT LINE STICKS

▶ These grips are an adaptation of the standard Crescent Grip which has earned a reputation with line crews everywhere for being jamproof, slip-proof and instantly releasing.

Operation is simple for linemen familiar with the use of hot line sticks. Grip is held open by engaging notch "B" in bottom of frame loop. Grip is then placed on wire by means of eye "A". Latch "D" is swung into place with hot line stick. Jaws are closed by action of spring "C" when engagement of notch "B" is tripped by upward movement of the pulling eye arm. Grip is released by placing hot line hook on rivet stud "E" and pulling until notch "B" engages frame loop.

Made in three sizes; each grip tested to its safe load capacity. Cadmium plated.

SPECIFICATIONS

SERRATED JAWS	MAXIMUM CAPACITY	MINIMUM CAPACITY
No. 383 HL	5/16 (.3125)" 8 mm	5/32 (.156)" 4 mm
No. 384 HL	1/2 (.500)" 12.2 mm	1/4 (.250)" 6.5 mm
No. 385 HL	3/4 (.750)" 19 mm	3/8 (.375)" 9.5 mm

No. 383-2 HL, 384-2 HL and 385-2 HL same, except with smooth jaws for bare aluminum wire.

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

On August 31, 1954, a group of New England

NEW ENGLAND ELECTRIC SYSTEM

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

EASTERN UTILITIES ASSOCIATES

CENTRAL VERMONT Public Service CORPORATION

WESTERN MASSACHUSETTS Electric COMPANY

NEGEA NEW ENGLAND GAS AND ELECTRIC ASSOCIATION

THE HARTFORD ELECTRIC LIGHT COMPANY

CENTRAL MAINE POWER

BOSTON EDISON COMPANY

C L&P THE CONNECTICUT LIGHT AND POWER COMPANY

utilities formed the A E ATOMIC

Electric Company, a cooperative venture

designed to give each utility experience in

The reactor selected:

The core in Yankee's reactor is rated initially at 110,000 kwe net, to be raised later to the plant's full rating of 136,000 kwe net. Fuel consists of 3,470,000 enriched uranium dioxide pellets weighing 52,190 lb. Westinghouse furnished Yankee with a complete nuclear package—fuel assemblies, "canned" motor-pumps, instrumentation and controls, valves, control rod drive mechanisms and steam generators.

using nuclear power.

a Westinghouse closed cycle water reactor.

Westinghouse and Stone & Webster Engineering Corp

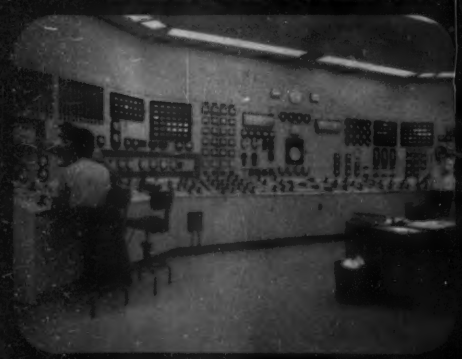
design and plant construction at Rowe, Massachusett

2000-acre site. On April 24, 1959, the first major elec

delivered. On February 7, 1960, the 165-ton reactor ve

On November 10, the plant delivered its first energy t

Yankee's 1800-rpm, 60-cycle Westinghouse steam turbine generator is rated at 160 mva. Yankee is a base load plant and will represent about two percent of New England's installed capacity. By training personnel in the operation of a full-scale atomic power plant now, participating utilities will be able to take quick advantage of anticipated technological advances and economics as knowledge and experience grow.



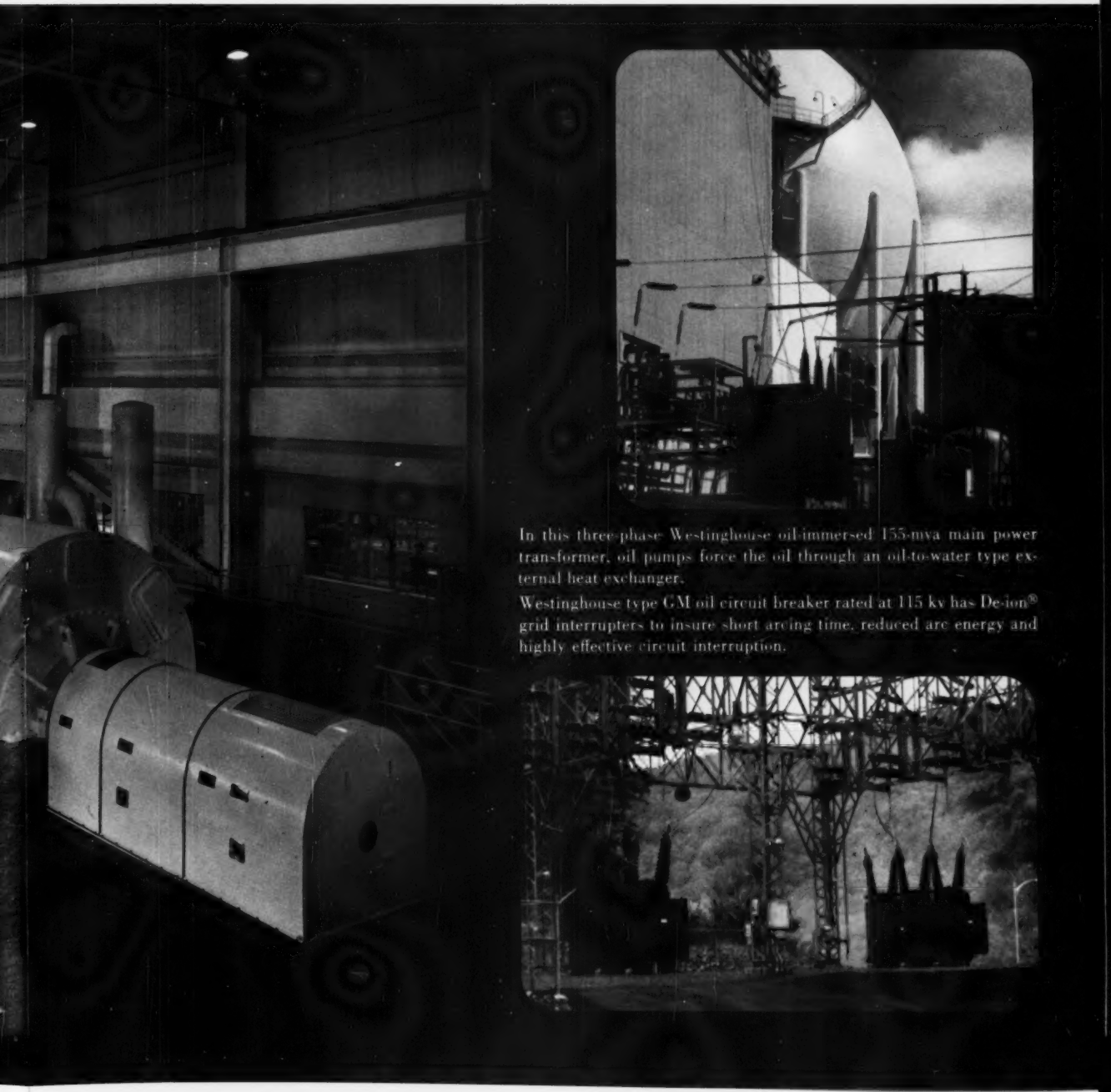
rporation were authorized to proceed on engineering

etts. On March 17, 1958, excavation was begun at the

ectrical equipment—the 160-ton generator stator—was

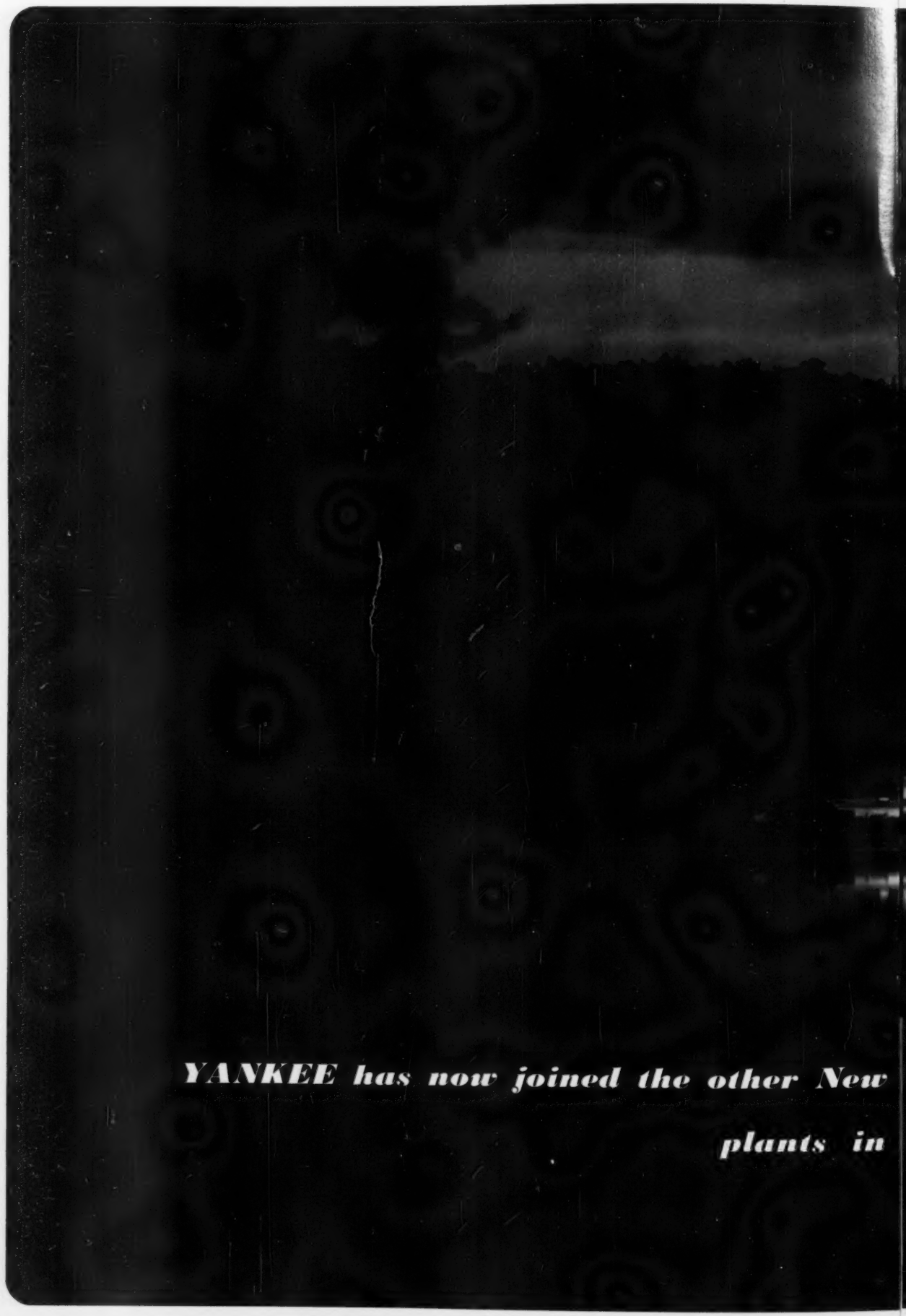
vessel arrived. On August 19, the reactor went critical.

g to New England's integrated electric power system.



In this three-phase Westinghouse oil-immersed 155-mva main power transformer, oil pumps force the oil through an oil-to-water type external heat exchanger.

Westinghouse type GM oil circuit breaker rated at 115 kv has De-ion® grid interrupters to insure short arcing time, reduced arc energy and highly effective circuit interruption.


YANKEE has now joined the other New
plants in

England generating

supplying the region's electrical needs.

In atomic power, too, you can be sure . . . if it's Westinghouse.

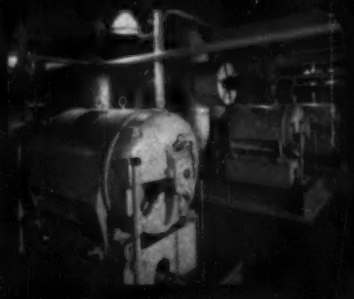
Westinghouse has also provided:

condensers

switchgear

switches

pumps



motors

dry-type transformers

and . . .

power centers, motor control centers, distribution panels, potential devices, elevator, relays, instruments, lightning arresters, fans and blowers.

CP-1061
FILE NO.-EU

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New Wire and Cable Casebook

from Du Pont tells you why

THERE'S NO DOUBT ABOUT NEOPRENE JACKETING

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Exterior lighting for American Airlines' new passenger terminal at Idlewild is served by dependable neoprene-jacketed cable.

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Du Pont will send you the *Wire and Cable Casebook* free, four times a year. Take advantage of this new way to keep informed about neoprene, HYPALON® and the newer Du Pont elastomers. Fill out the coupon and mail it . . . *today*. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department, Wilmington 98, Del.

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EW-2

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Better Things for Better Living
. . . through Chemistry

this is my signature

I'm Stan Martys, assembler of LTC selector switches. I've worked in C.A.A.D., the Control Apparatus Assembly Department, of Pennsylvania Transformer for many years. When I complete an assembly, I stamp it with my code initials. Along with the Inspector, I sign the assembly report in my own handwriting. This way I get the credit and take the responsibility for what I believe is a quality job. I take pride in my work, and I sure don't hesitate to take the responsibility for it.

The rest of the men in the department, making contactors, selectors and drive mechanisms, sign out their jobs the same way.

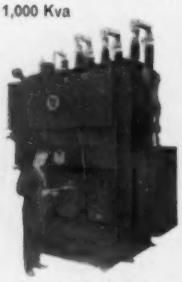
After these pieces (we call 'em subassemblies) are put together into a complete LTC unit, they get a *real* test workout. It's the kind of test that shows up *any* trouble *anywhere*. The long and short of it is that we end up with LTC equipment about as close to 100% perfect as you can get. Then the finish assembler puts his John Henry on his work and on the assembly report. The inspector does the same and seals the unit.

We're all human and there are a lot of chances to make mistakes when building LTC or other equipment. But the way we're set up, starting with 100% checking of machined parts, then going through a positive check-out system clear through assembly, the chances are about zero. The people using Pennsylvania LTC transformers and regulators are bound to get years and years of trouble-free service.

For complete description on all single-phase and three-phase regulating equipment, please request Bulletin #81. Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

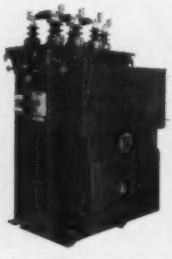
PENNSYLVANIA 3-PHASE LTC EQUIPMENT	
Type	**Ranges for Application**
550	Step Voltage Regulators 120 thru 1000 kva. LTC transformers 10,000 kva and below.
331 or 333	Step Voltage Regulators 1001 thru 2500 kva. LTC transformers, LTC autotransformers and regulating transformers from 10,001 thru 50,000 kva.
442	LTC transformers, LTC autotransformers and regulating transformers 50,001 thru 250,000 kva.

1,000 Kva



Phase-Isolated LTC Transformers

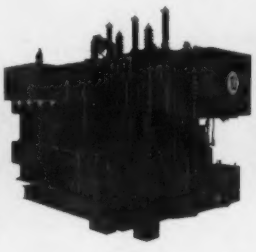
225 Kva



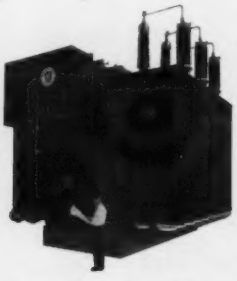
Three-Phase Step Voltage Regulators

Three-Phase Load Tap Changing Transformers

2,500 Kva



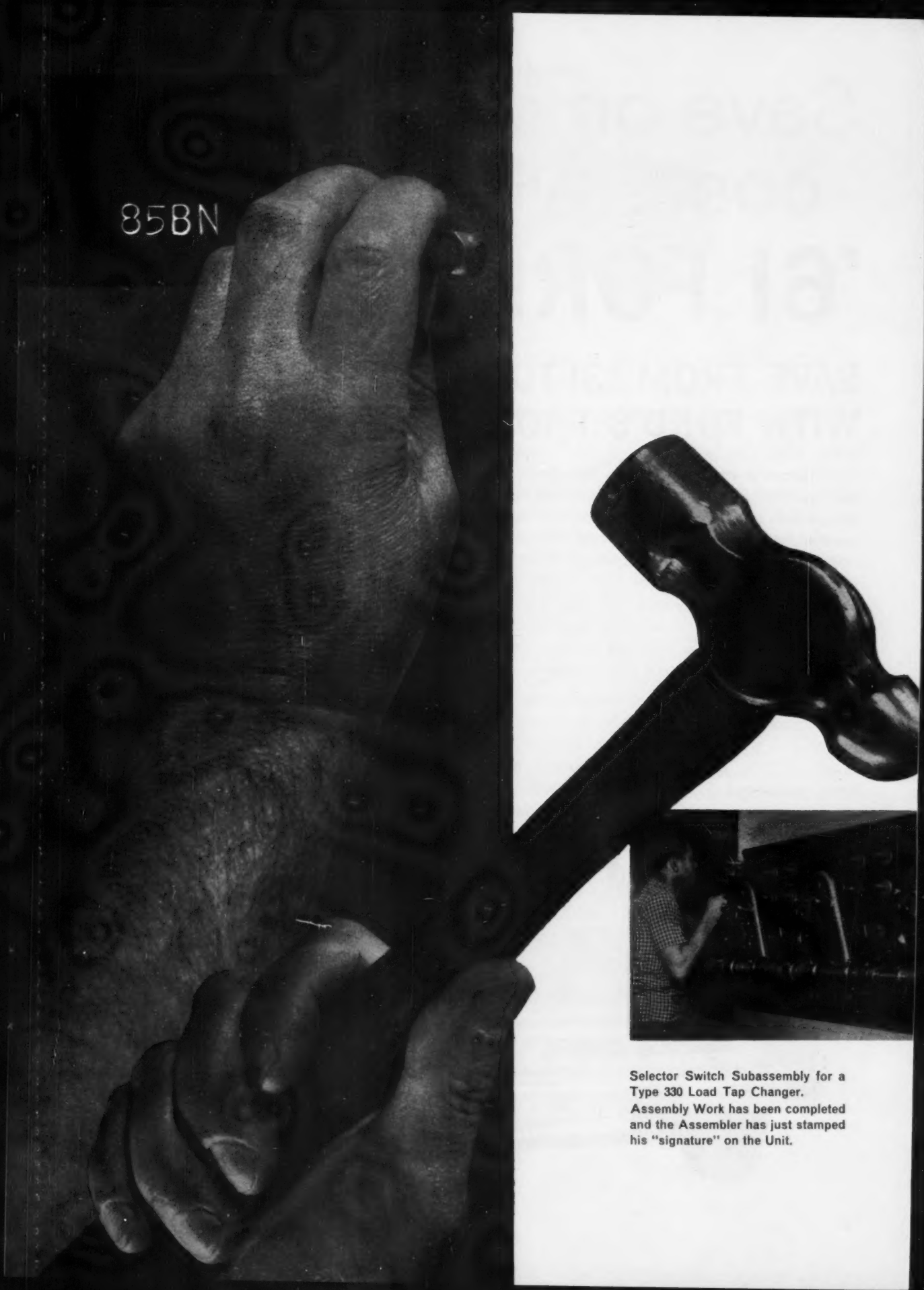
50,000 Kva



60,000/80,000/100,000 Kva

McGRAW EDISON **PENNSYLVANIA TRANSFORMER DIVISION**

PENNSYLVANIA TRANSFORMERS



Selector Switch Subassembly for a Type 330 Load Tap Changer. Assembly Work has been completed and the Assembler has just stamped his "signature" on the Unit.

Save on construction costs with the new '61 FORD TRUCKS

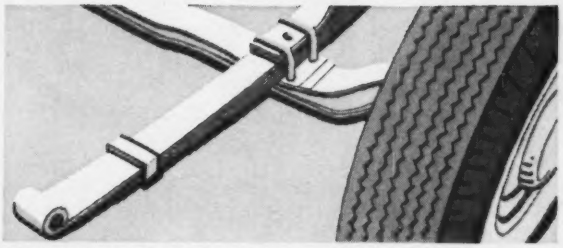
SAVE FROM $31 TO $157 ON PRICE* ALONE WITH FORD'S F-100 STYLESIDE PICKUPS

Contractors everywhere are finding that the half-ton Ford Styleside is priced below all other comparable pickups! And these rugged pickups are designed to keep right on saving with lower maintenance and operating expenses. Their durable, one-piece cab-and-box construction provides increased rigidity and eliminates a major source of rust and corrosion. Not only does the sheet metal last longer with this stronger body, but it also contributes to a quieter ride.

And you can save more . . . because you can carry more on every trip. Styleside bodies are longer and wider with loadspace increased as much as 16%. In addition, wheelbases have been lengthened 4 inches and this combined with the improved shock absorbers gives a ride that's unexcelled in its field—proven by scientific Impact-O-Graph tests. For construction work the angle of approach has been increased so you can climb steeper drives or go over deeper ditches or gullies. Ford also offers America's lowest-priced* 4 x 4 with big 8-ft. box, the F-100 Flareside.

And you can save on operating expense! Ford's Mileage Maker 223 Six is standard on all conventional pickups to keep gas costs low. The economical 292 V-8 is available for jobs requiring extra power. Both engines are equipped with Ford's Full-Flow oil filter that lets you get 4,000 miles between oil changes.

**Based on a comparison of latest available manufacturers' suggested retail delivered prices*



SAVE UP TO $150 ON FRONT TIRES! In certified tests of truck suspensions, Ford front tires lasted up to twice as long. In 50,000 miles, savings can add up to $150 on a pickup . . . more on two-tonners. And Ford's sturdy I-Beam front axle and leaf-spring suspension not only cut tire wear, but their simpler design also cuts maintenance costs.

12,000 MILE OR 12 MONTH WARRANTY

SAVE WITH GREATER DURABILITY . . . on all 1961 Ford Trucks, each part, except tires and tubes, is now warranted by your dealer against defects in material and workmanship for 12 months or 12,000 miles, whichever occurs first. The warranty does not apply, of course, to normal maintenance service and to the replacement in normal maintenance of parts such as filters, spark plugs and ignition points. Never before have you had such protection . . . such evidence of long-term economy!

SAVE WITH FORD'S NEW 262-CU. IN. "BIG SIX" ALL-TRUCK ENGINE FOR TOP PERFORMANCE AND ECONOMY

America's savingest two-tonners offer a big 262 Six with the power of big displacement, the gas economy of 6-cylinder design, plus the durability of heavy-duty construction. This engine features a sturdy stress-relieved block, strong forged steel crankshaft, long-lasting stellite-faced intake and exhaust valves, and durable pyramid-type connecting rods. And Positive Crankcase Ventilation reduces oil dilution and sludge formation to extend engine life. Ford's proven 292 V-8 and 292 HD V-8—the V-8's with "six-like" economy—are also available for your special power needs.

You also save with other new durability features like the more rugged frame, stronger radiator with new lock-seam construction, improved cab and chassis electrical wiring, plus longer, easier-riding and more durable rear springs. Ford's parallel ladder-type frame with standard 34-inch width allows you to install new or transfer your present special construction bodies quicker and for less. Also, the frame drop in the cab area lowers cab height . . . makes for easier entry.

FORD TRUCKS COST LESS

YOUR FORD DEALER'S "CERTIFIED ECONOMY BOOK" PROVES IT FOR SURE...

FORD DIVISION, *Ford Motor Company*

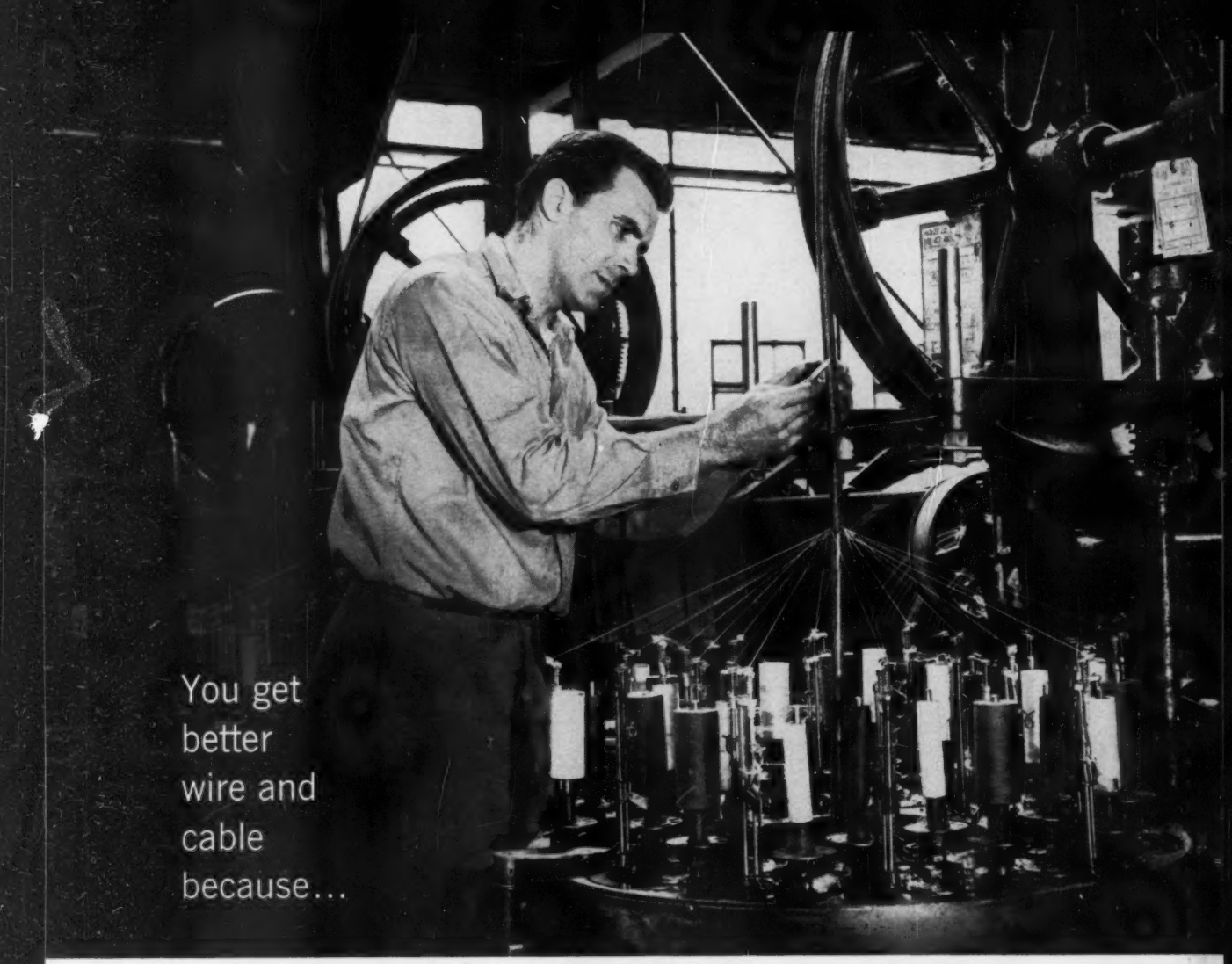
why can't everybody build switchboards like this?

The answer is simple: only Federal Pacific has the Rotary Handle QMQB fusible switch units with visible blades... with the high-current capacity of a circuit breaker... with the 200,000 ampere interrupting capacity of fuses. Some manufacturers still use welded angle frames of 16 or 14 gauge steel plates. Federal Pacific utilizes bolted channel construction of 11 gauge steel for maximum strength and rigidity. What's more, Federal Pacific switchboards are designed on the modular principle: when you need to control more power, you can add units or entire sections — quickly and easily. Look again at the switchboard shown! It looks as new on the outside as it is on the inside—thanks to the Raymond Loewy design—exclusive with Federal Pacific. And if you think all this costs more, you're in for a pleasant experience when you contact your Federal Pacific representative. Write for Bulletin 2100, Dept. FP-7, Federal Pacific Electric Co., Newark 1, N. J.

FEDERAL PACIFIC ELECTRIC COMPANY

FPE

growth through creative energy



NEARLY EVERYONE AT CIRCLE'S AN "INSPECTOR"

Take Oscar Stangoni, braiding machine operator at Circle.

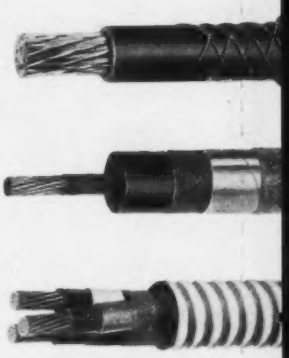
Mr. Stangoni doesn't need to use a micrometer. Ordinarily, his foreman sets up the machine, checks with a "mike" at the beginning of a run and several times during a run to make sure that the O.D. is OK.

But Oscar Stangoni uses one just the same—and he uses it often. Why? Maybe pride or a sense of responsibility—or maybe just because he feels better when he also knows the cable is absolutely right.

This is just one of many ways in which Oscar Stangoni and hundreds more like him at Circle make sure that the wire and cable they turn out is as good as it can possibly be.

And that's another reason, we believe, why Circle products have achieved their reputation for quality.

Next time you specify cable, we suggest you ask for Circle. There's no finer cable made. CIRCLE WIRE & CABLE CORP., Maspeth, N. Y.

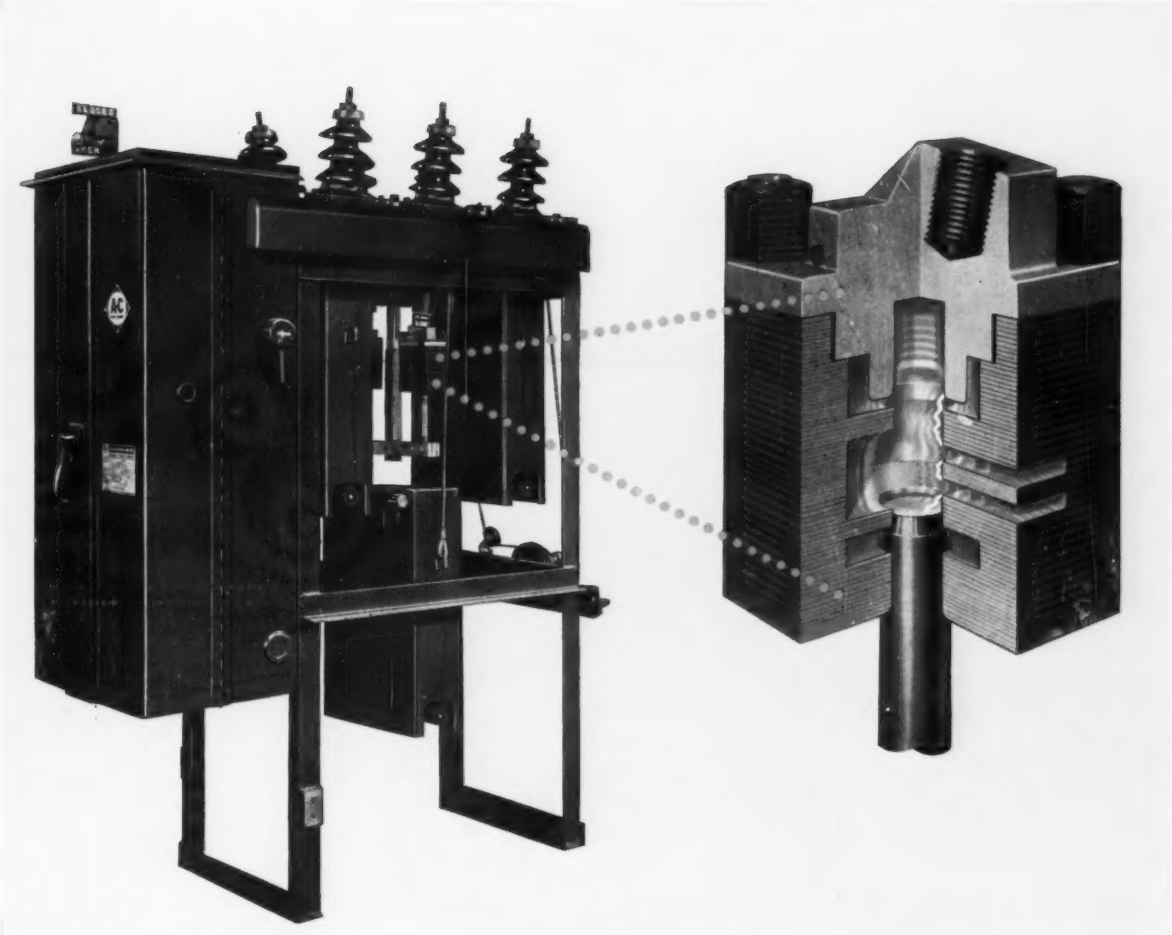


CIRCLE WIRE & CABLE CORP.

SUBSIDIARY OF **CERRO CORPORATION**

RUBBER COVERED WIRE & CABLE • VARNISHED CAMBRIC CABLE • PLASTIC INSULATED CABLE • NEOPRENE SHEATHED CABLE • CIRTUBE* EMT

ALLIS-CHALMERS



Allis-Chalmers outdoor distribution breaker

cuts interrupting time with a cross-blast

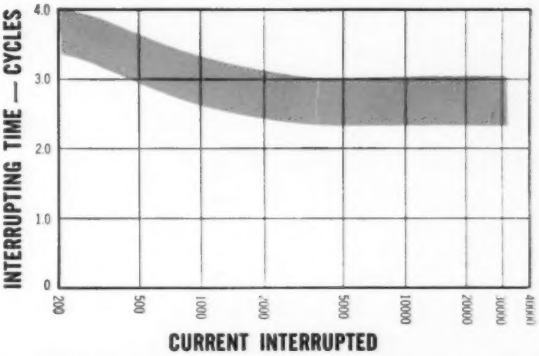
New cross-blast interrupter dramatically speeds arc extinction, sharply reduces oil contamination and maintenance in Allis-Chalmers 500-mva distribution circuit breakers. A unique gas blast literally blows out the arc.

New stored-energy operator (optional on 100, 250 and 500-mva sizes) for safe, manual or electrical, full-speed closing of breaker, even with loss of control power. (Mechanically and electrically trip-free solenoid operator is standard.)

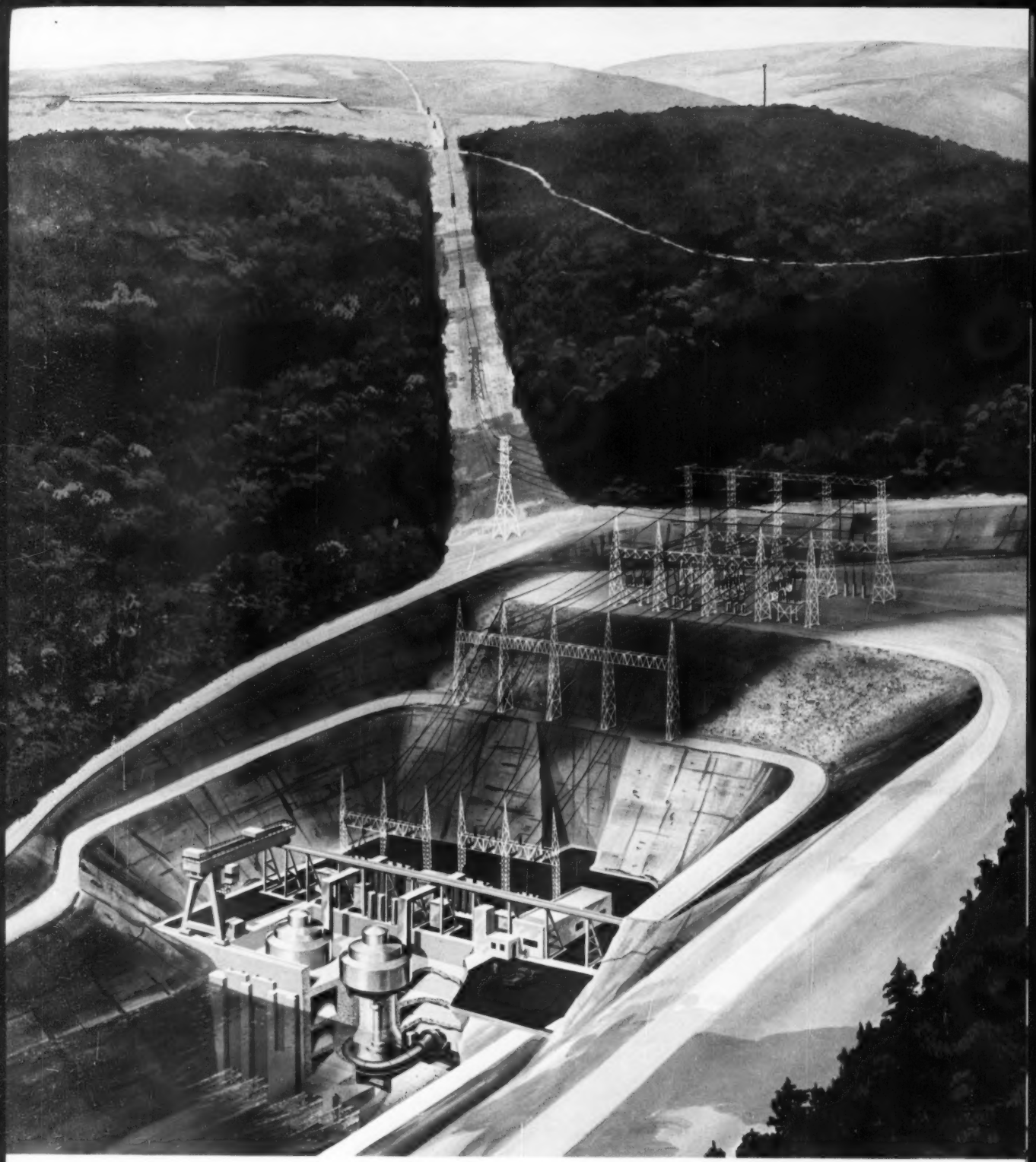
Three-tank protection — an Allis-Chalmers exclusive — *positively* eliminates phase-to-phase flashover! Here's phase isolation comparable to rugged transmission-type breakers. No other distribution breaker compares in all-around safety, ready accessibility, ease of maintenance.

Phone your nearby A-C office for more information, or write **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wisconsin.*

A-1367



Swift interruption over the entire range of operating currents cuts carbonization to the lowest level ever.



TAUM SAUK

Union Electric Co. • St. Louis, Mo.

Pumped-Storage Project to have the two largest-capacity hydro units ever built. Total capability of these reversible pump-turbines is more than 600,000 HP under 800 ft. head. This—first in pure regeneration—is another example of Allis-Chalmers product leadership. *Write Hydraulic Division, York, Pa. for additional information.*

ALLIS-CHALMERS

Editorial Comment

FEBRUARY 13, 1961

Business–Government Relationships Beg for Better Atmosphere

Mississippi Valley Generating Co, the Dixon-Yates combine, has been told by the US Supreme Court it can't recover damages for work it did toward a steam plant that was never built because the government terminated the contract.

Thus we see (EW, Jan. 16, p 44) another weird episode in the history of government-private business relationships. Today, with government and business in need of each other's cooperation as never before, it is to be hoped that such episodes will be a thing of the past.

The government asked a group of utility men to build the plant for service to the Atomic Energy Commission, contracted with them to do so, and then cancelled on a technicality. It is clear that the high court's decision can set a very discouraging tone for businessmen who honestly desire to respond to government requests for cooperative action.

And this case is not isolated. That Pacific Gas & Electric Co's response to US Bureau of Reclamation's request for cooperative development of Trinity River falling water was rejected, was disappointing; but that the Bureau's initial approval of the PG&E proposal was not supported in the face of slashing political attack was most disturbing.

To us, there is mutual danger inherent in such episodes. President Kennedy has called for all to "ask what we can do for our country." We submit that an atmosphere of greater harmony, relative to the past, generated on the government's part will do much to enhance responsiveness.

On the other hand, there is grave danger that businessmen, mindful of the past, may reflect that "turning the other cheek" is a poor philosophy in a hard-bitten world. We urge them to reflect on two points. First, today's world, while yet hard-bitten, is a different one than that in existence in calmer, more peaceful times and calls for different considerations. Secondly, there is nothing that would please federal power advocates more than to have investor-owned companies turn their backs on the government. It would make their job very much easier.

'Inferior End Use' of Gas Needs Testing, Definition

Power plant air-pollution control encounters another obstacle. This time it is the January decision of the US Supreme Court against Consolidated Edison Co of New York. The Court, reversing a lower tribunal, declared that the Federal Power Commission has the authority to block sales of natural gas on the newly but imperfectly defined "inferior end use" doctrine.

It is with agonizing interest that many electric utilities will watch ensuing events. A number of the companies serving metropolitan areas are in urgent need of gas supplies for burning beneath their boilers for smog control. Some have been unable to ensure firm supply over periods of especially stringent air-pollution circumstances and have been pushing for supplies which are not subject to withdrawal at the very time they are most needed. But the high court's decision may change all the ground rules.

Another early test of the "inferior end use" doctrine may come as Southern California Edison Co attempts to secure an independent source of gas in Texas. It is to the ultimate good of the industry that as many tests of the new policy are made as soon as possible. Under such general definition as the FPC has thus far laid down, conjecture as to long-term effects is running rampant.

We commend Con Ed's terse statement that "We're not going to quit as long as there is an avenue open." Indeed, every possible avenue must be explored.

Fines and Sentences End Long

(*Also see p* 16)

Climax to a year and a half of litigation came to an end when Federal Judge J. Cullen Ganey imposed sentences on electrical manufacturers and individuals involved in federal antitrust indictments. In the opening session, Judge Ganey made the following statement:

"Before imposing sentence, I want to make certain observations concerning the bills of indictment here involved.

"They cover some 48 individual defendants and 32 corporations which comprise virtually every large manufacturer of electrical equipment in the industry. This is a shocking indictment of a vast section of our economy; for what is really at stake here is the survival of the kind of economy under which America has grown to greatness, the free enterprise system.

"The conduct of the corporate and individual defendants alike, in the words of the distinguished Assistant Attorney General who headed the antitrust division of the Department of Justice, have flagrantly mocked the image of that economic system of free enterprise which we profess to the country and destroyed the model which we offer today as a free world alternative to state control and eventual dictatorship. Some extent of the vastness of the schemes for price fixing, bid rigging and job allocations can be gleaned from the fact that the annual corporate sales covered by these bills of indictment represent a billion and three-quarter dollars. Their pervasiveness likewise may be judged by the fact that the sales herewith are concerned with a wide variety of products and were made not only to private utilities throughout the country, but by sealed bids to federal, state and municipal governments.

"This Court has spent long hours in what it hopes is a fair appraisal of a most difficult task. In reaching that judgment, it is not at all unmindful that the real blame is to be laid at the doorstep of the corporate defendants and those who guide and direct their policy. While the Department of Justice has acknowledged that they were unable to uncover probative evidence which could secure a conviction beyond a reasonable doubt of those in the highest echelons of the corporations here involved, in a broader sense they bear a grave responsibility for the present situation, for one would be most naive indeed to believe that these violations of the law, so long persisted in, affecting so large a segment of the industry and finally, involving so many millions upon millions of dollars, were facts unknown to those responsible for the conduct of the corporation and, accordingly, under their various pleas, heavy fines will be imposed.

"As to the individual defendants, the Attorney General who secured the indictments and the present Attorney General who has, by letter, wholeheartedly agreed with the government's recommendation that in the great majority of cases in well documented briefs strongly insisted on the individual defendants serving prison sentences due to the serious nature of their violations.

"It is not to be taken as disparaging of the long and arduous effort the government has made, and even more, the highly efficient and competent manner of its doing, that only in those instances where ultimate responsibility for corporate conduct amongst those indicted, vested, are prison sentences to be imposed. Rather am I convinced that in the great number of these defendants cases, they were torn between conscience and an approved corporate policy, with the rewarding objectives of promotion, comfortable security and large salaries—in short, the organization or the company man, the conformist, who goes along with his superiors and finds balm for his conscience in additional comforts and the security of his place in the corporate set-up. In that this can in any wise be a defense to their misconduct is conceded but long probationary periods where a watchful eye can be kept on their activities, fines will suffice for their first offense.

"But this is the sordid, greedy side of the situation and yet there is a bright side. Each and every one of those indicted, both corporations and individuals, faced up to the situation realistically and readily admitted by pleas of guilty and *nolo contendere*, their violations. For this, much must be said, not alone in the saving of great time and expense to the government in preparing and trying these indictments which would have covered some two or three years, but above and beyond that it would cause to point up and emphasize an already unsavory past, which these admissions of guilt, it is hoped, will quickly move this great industry to a thorough reappraisal of their various competitive systems and help move the nation's economy forward under the banner of free enterprise."

Companies Answer Charges

General Electric followed Judge Ganey's statement with an emphatic denial that actions of individuals in their employ were in conformance with company policy or "alleged conformity to a supposed corporate way of life."

The GE statement says:

"During the proceedings in court on Dec. 8, 1960, it was stated on behalf of the Department of Justice that 'the government has not charged and does not claim that any member of the Board of Directors of the General Electric Co, including Ralph J. Cordiner, chairman, and Robert Paxton, president, had knowledge of the conspiracies pleaded in the indictments, nor does the government claim that any of these men personally ordered or authorized the commission of any of the acts charged in any indictment.'"

Mark W. Cresap Jr., Westinghouse president, had this to say:

"Management's attitude toward the individuals involved in the antitrust indictments (is that) . . . while their actions cannot in any way be condoned, these men did not act for personal gain, but in the belief —misguided though it may have been—that they were furthering the company's interest.

"Each of these individuals is in every sense a reputable citizen, a respected and valuable member of his community and of high moral character."

Electrical Antitrust Cases

JUDGE GANEY

Here are the fines and sentences imposed on individuals charged in the indictments:

Power transformers: J. H. Chiles Jr (WE) $2,000 plus 30 days; W. S. Ginn (GE) $5,000 plus 30 days; R. N. McCollom (WE) $2,000 plus 30 days suspended; J. W. McMullen (A-C) $3,000 plus 30 days suspended; J. W. Seaman (GE) $2,500 plus 30 days suspended; R. W. Smith (GE) $3,000 plus 30 days suspended; W. R. Swoish (ME) $5,000 plus one month suspended.

Power switchgear assemblies: Lewis J. Burger (GE) $2,000 plus 30 days; George E. Burens (GE) $4,000 plus 30 days; Landon Fuller (WE) $3,000 plus one month suspended; H. F. Hentschel (GE) $2,000 plus one month suspended; Houston Jones (GE) $1,500; L. W. Long (A-C) $2,000 plus 30 days suspended; Frank M. Nolan (A-C) $1,000; A. W. Payne $1,000; Frank E. Stehlik (GE) $3,000 plus one month suspended; J. T. Thompson (WE) $2,000; David W. Webb (A-C) $1,000.

Turbine-generator units: W. S. Ginn (GE) $7,500; C. I. Mauntel (WE) $1,000 plus 30 days; W. C. Rowland (WE) $4,000 plus one month suspended; W. E. Saupe (GE) $5,500 plus one month suspended.

Industrial control equipment: J. M. Cook (C-H) $2,000 plus 30 days; T. C. Finnell (WE) $1,500; E. R. Jung (CC) $2,000 plus 30 days; F. F. Loock (A-B) $7,500; W. F. Oswalt (GE) $4,000 plus 30 days suspended.

Power switching equipment: J. E. Cordell (SS) $1,500 plus one month suspended; W. T. Pyle (WE) $1,000; G. L. Roark (GE) $1,500; John Romano (HKP) $1,500 plus one month suspended; H. K. Wilcox (I-T-E) $1,500 plus one month suspended; W. Maxwell Wood (SW) $7,500 plus one month suspended.

Distribution Transformers: M. A. deFerranti (GE) $3,500 plus 30 days suspended; Gordon C. Hurlbert (WE) $2,000 plus 30 days suspened; W. R. Swoish (ME) $3,500; A. R. Waehner (ME) $1,500; Joel Watkins (KE) $2,500.

Oil and Air Circuit Breakers: Clarence E. Burke (GE) $3,500 plus one month suspended; Royce C. Crawford (GE) $2,000; L. W. Long (A-C) $1,500 plus one month suspended; William H. Schiek (GE) not sentenced yet due to illness; J. W. Stirling (WE) $1,500 plus one month suspended.

Low-Voltage Power Circuit Breakers: R. W. Ayres, Jr (GE) $1,000; W. T. Pyle (WE) $1,500; Frank E. Stehlik (GE) $2,500; J. T. Thompson (WE) $2,000.

Steam condensers: H. G. Conkey (I-R) $4,000 plus 30 days suspended; M. H. Howard (FW) $2,000; C. I. Mauntel (WE) $1,500; L. G. L. Thomas (CHW) $4,000 plus one month suspended; A. M. Tullo (Worthington) $3,000 plus 30 days suspended.

News Scope

SEEKS CLARIFICATION — Illinois Power Co has filed a petition with the Illinois Commerce Commission asking that three electric distribution cooperatives and a generating station and transmission cooperative by declared public utilities and required to comply with provisions of the Public Utilities Law. The three co-ops have organized the G&T one in order to build a power plant to supply energy for them. Illinois Power wants the co-ops to have to obtain certificates of convenience and necessity.

BATTLES AHEAD—Two pieces of legislation before Washington state legislature and involving electric utilities face stiff opposition. One, introduced recently with bipartisan support, would require any PUD seeking to condemn properties of a private power company to hold an election on the proposal 120 days after such a decision is reached by the PUD commission. The other bill, which would exempt two Tacoma City Light dams from an initiative barring dam construction on the Cowlitz River, has been approved by the state Senate's public utilities committee by a vote of 14 for, three against, six neutral—but there are doubts the two-thirds majority needed can be obtained.

RATE BOOST OKAYED—Indiana Public Service Commission has approved a rate increase for about 328,000 customers of Public Service Co of Indiana. Rural Electrification Membership Corp customers who buy power from the utility will not be affected by the $4,998,456—less than 6%—annual increase in gross operating revenues.

PRESSES TAKE-OVER—Tennessee Valley Authority should take over operation of Memphis' electric generating plant and let the city buy its power from TVA. This was the recent recommendation of the Memphis Utilities Study Committee to the City Commission. The study group said its plan would put the city in a more competitive position to offer cheaper power rates to industry. The major recommendation of the committee, which studied Memphis Light, Gas & Water Division, was a long-term power supply contract with TVA. If such agreement can't be reached: (1) Rates would have to rise 5 to 20% to meet the proposed $45-million capital expenditure program in the next five years; and (2) The division should negotiate a power contract with TVA. If neither contract can be reached, building of additional generating units—requiring a electric rate hike—would have to be considered, the study group declared.

L.A.-Pasadena Reactor Called Off

Construction of the improved cycle boiling water reactor scheduled to be built by the cities of Los Angeles and Pasadena at Haskell Canyon in Los Angeles county has been called off.

The AEC Advisory Committee on Reactor Safeguards has ruled that the site is not feasible for a future 300-Mw reactor, for which the 50-Mw unit proposed by the two cities was to have been a prototype.

Smog Cited as Reason

The Advisory Committee said atmospheric conditions in southern California are inclined to trap smog at low altitudes and could prevent radiation from a larger nuclear power plant from rising above populated areas. For this reason, it ruled the site inadvisable for the proposed 300-Mw unit.

The cities of Los Angeles and Pasadena had threatened to pull out of the 50-Mw project unless they received assurances that they could proceed safely at some later date with construction of the larger reactor. The Advisory Committee could give no such assurances without further environmental and atmospheric dispersion studies.

Los Angeles and Pasadena then notified the AEC that they were withdrawing their proposal for construction of the 50-Mw nuclear power plant and would concentrate efforts on finding a suitable site for a larger nuclear plant.

Authorization for the action was approved by the L. A. board of water and power commissioners, following a report by Samuel B. Nelson, department general manager and chief engineer, on cost and site problems that have arisen in recent months. The Pasadena Municipal Light & Power Department joined in the announcement withdrawing participation in the proposed project.

"We find it necessary to abandon our original plans for the project because of the rejection by the AEC of use of the proposed 50-Mw plant site for larger units at a future date," Nelson said.

"The AEC restriction to a single-purpose use of the site would have increased the cost of the project beyond reasonable economic limits," it was stated.

Los Angeles engineers estimated that this factor, plus other unanticipated fuel, maintenance and operation expenses would increase the cost of the experimental installation by $700,000 anually. The Los Angeles and Pasadena utilities had planned to share equally the project operating expenses as well as an estimated $10-million construction cost.

In a letter to John S. Graham, acting AEC chairman, Nelson said Los Angeles will continue to be interested in the use of nuclear energy for generation of electric power but cannot justify further participation in the original proposal. T. M. Goodrich, general manager and chief engineer of the Pasadena utility, joined in signing the letter to Graham.

Will Seek New Site

"The department now will concentrate its efforts in finding an economical and acceptable nuclear site for a nuclear plant of possible 300-Mw size, to be built when it will be competitive with conventional power generating plants, such as the Haynes plant now under construction near Seal Beach," Nelson told the board of water and power commissioners.

Four department engineers who are members of a special nuclear power group, trained in large eastern atomic development centers, will participate in meteorological and hydrological studies for a new site, it was announced. They also will be assigned on a temporary basis to participate in design and operation of large nuclear power plants being built or planned in other parts of the nation.

Western Farmers Electric Cooperative of Anadarko, Okla., the only other bidder last May, was surprised to hear that L. A. and Pasadena had pulled out and said "We'll have to get our heads together on it" to see whether to renew interest in the proposal. The prospective bidder, Allis-Chalmers Manufacturing Co, has contacted the co-op to see if it's interested in reconsidering construction of the unit.

Delaware River Water Compact Signed

A long-range plan for development and control of the Delaware River waters took its first step toward reality this month as representatives of the federal government, four states and two cities gave it their formal approval. The 100-year self-renewable compact, which includes the federal government as a full partner, along with the states of Pennsylvania, New York, New Jersey, and Delaware, is expected to follow a $437-million plan prepared by the Corps of Engineers last year.

The plan includes 58 storage projects on the Delaware and its tributaries. Largest of the projects will be the $93-million dam and reservoir at Tock's Island, where New Jersey Power & Light Co is planning a 400 to 550-Mw pumped storage project (EW, Oct. 31, 1960, p 48). The 15,000-acre reservoir formed by the Corps dam will be the lower reservoir of the pumped storage project and the site of the pumping and generating station.

In all, the new compact calls for production of some 385 million kwhr per year in the 265-mile long area. The compact must be passed by the legislatures of the four states and by Congress.

Commenting on the compact, J. K. Busby, president of Pennsylvania Power & Light Co, said, "It is important that, although federal government representation is provided for, the commission set up by the compact will be essentially a state affair and thus be in the best position to be responsive to the needs of the people involved." An adequate water supply for the future, he continued, is a vital element in effective area and community development.

Kerr Report Backs Administration Views

This is a continuation of the report that was started last week (EW, Feb. 6, p 39).

• The Administration should prepare biennial water supply and demand outlooks for each of the 22 water resource regions.

And the President should be requested to submit to Congress, by January, 1963, the first of these reports.

These recommendations dovetail with Kennedy Administration plans to create a permanent White House council on national resources and policies. Sen. Clair Engle (D-Calif.) already has introduced such a bill (S-239), and it has been referred to the Senate Interior committee for consideration.

The Kerr recommendations were based on five conclusions:

(1) Stream flows must be regulated through additional surface reservoirs and watershed management.

(2) Pollution abatement programs must be increased to improve the quality of stream flows.

(3) Better use of underground storage should be developed.

(4) Increased efficiency of water use should be developed: ending of wasteful practices, improved sewage treatment, re-circulation of water, increased irrigation efficiency, substitution of air-cooling for water-cooling at industrial plants (such as some European refineries have developed).

(5) Increase natural water yields through desalting, weather modification and other artificial means.

The committee points out that minimum 1980 storage additions, over 1954, for river regulation, must be 315 million acre-ft; the 2,000 additions to storage, over 1954, must be 442 million acre-ft. Development of underground storage could reduce this, the committee adds, and such underground storage might be developed through nuclear explosions.

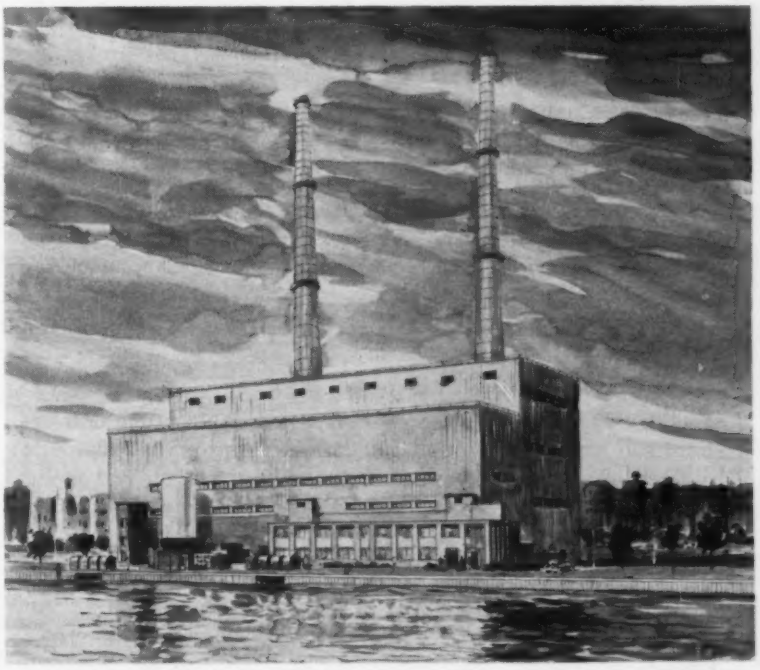
Industrial water use will continue to grow, says the committee, but "industry is capable of adjusting to considerably smaller supplies through water conservation practices"—the major industrial problem is pollution. Pollution control through 1980 should be aimed at "the cheapest combination of waste treatment facilities and storage to provide sustained flows," it says.

Regional water shortages have developed, and are developing. The south Pacific region already has reached maximum use of its available water supplies; maximum use will be reached by 1980 in four other regions: Colorado River Basin, the Great Basin, upper Rio Grande-Pecos River Basin, Upper Missouri River Basin; three more regions will hit maximum use by 2000: the upper Arkansas-Red River Basins, the western Great Lakes area (excluding use of lake-water), the western Gulf basin.

Most of these problems could be met by inter-basin water transfers, points out the committee, or from promising research programs such as desalting sea water and weather control.

The pressure for added water development will come from a two-fold population increase by 1980, a three-fold increase by 2000, states the report; and there will be a 10-fold increase in water-related recreation needs.

Specific legislation to implement the Kerr report is expected to be introduced, and considered, in the four Senate committees — Public Works, Interior, Commerce, Agriculture — which supplied members for the Senate water committee.



Ravenswood Plant to Generate 720 Mw

Ravenswood generating station, begun by Consolidated Edison Co in 1960, will add 720 Mw to the New York City utility's system. The station is part of an expansion program which will sink $1.1 billion into power development by 1965. $305 million will go to new equipment, machinery, and buildings in 1961 alone.

Con Ed's giant expansion program is necessary to keep pace with expanding power requirements in the New York area. Some indication of the increase in New York's power use can be gathered from the fact that in 1960, enough new housing was built in the company's area to house 140,000 people, the entire population of a city the size of Albany, N. Y.

Four Utilities in Edison Award Finals

Four trail-blazing electric utilities have been picked by the three-man review committee as final contenders for the Edison Electric Institute's Edison Award for 1960. The award is made annually to the electric utility whose accomplishments are judged of greatest importance to the electric industry and to the public. Only accomplishments which come to fruition in the award year are considered in the review process. The 1960 final candidates are:

American Electric Power Co—For significantly advancing steam-electric plant progress with 475-Mw Breed No. 1 and its sister unit Philip Sporn No. 5, the largest operated by investor-owned utilities, and the world's most efficient. Breed tested at 8,376 Btu per net kwhr, and together with Breed's associated 186-mile, double-circuit 345-kv transmission, the nation's longest EHV lines; for pioneering development of "bare hands" high-voltage live-line maintenance techniques; and for outstanding promotion of residential electric space heating, which added 6,000 completely electric homes to its lines, earned the nomination.

Georgia Power Co—For initiating new concepts in service entrance policies, wherein, by capitalizing facilities from the weatherhead through the service entrance panel, the company has broken the bottleneck of wiring costs to the customer, thereby widely expanding the potential use of major appliances, particularly in the older homes, apartments and rental properties; and for a vigorous follow-up resulting in thousands of installations to date.

Pennsylvania Electric Co—For pioneering the design and construction of America's first 460-kv transmission line operating as a major component of an integrated power system network; all accomplished within a period of approximately one year; and conceived as a practical prototype from which to obtain reliable cost data and practical operating experience for the benefit of the entire electric utility industry.

Southern California Edison Co—For its leadership in the development and promulgation of advanced management policies that have resulted in close integration of the management team and in expediting decisions on specific problems at all levels of supervision; and for an outstanding load development program that has resulted in the company achieving national leadership in the installation of Medallion homes.

The review committee this year included P. B. Garrett, editor and publisher of *Electric Light & Power,* C. F. Hochgesang, editor of *Electrical World,* and C. W. Leihy, publisher of *Electrical West.*

Original nominations are made by a panel comprising the 24 committee chairman of the EEI, plus 15 members at large, selected to balance out the geographic representation of the panel. Each of these 39 panel members selects three utilities he feels have made outstanding contributions. The review committee then narrows the list to a maximum of five companies, who are invited to submit presentations for the final award. A committee of judges, including C. W. Kellogg, past president of the EEI, Sherman Knapp, current president of EEI, and J. D. Ryder, dean of engineering at Michigan State University, makes the final selection.

CARY: Appointed SEC chairman

Two Are Selected Members of SEC

Two new members have been appointed by President Kennedy to the Securities & Exchange Commission. The appointments give Democrats a three-to-two majority on the agency.

William L. Cary, a law professor at Columbia University, was named commission chairman. J. Allen Frear, former Democratic Senator from Delaware who was defeated last November, was appointed to fill a second SEC seat.

Prof Cary is a specialist in corporate law and is the author of a textbook on this subject, which is widely used in colleges and universities. In addition to his teaching duties, Cary has been serving as special counsel for a Wall Street law firm. He plans to sever connections with the firm when he takes over SEC duties.

He is a native of Columbus, Ohio, a graduate of Yale Law School, and earned a Master's degree in business administration from Harvard.

In the late 1930's, Cary worked for two years at the SEC as an assistant counsel. He also held other government positions before joining the Marine Corps in 1942.

Frear was in the Senate for two terms. He was generally associated there with the conservative wing of the Democratic party, particularly on economic issues. His home is Dover, Del., and he is a graduate of the University of Delaware.

moved into the valley within a few months.

Swidler joined TVA's legal staff in November, 1933, did most of the leg work and research for the Authority's early law suits with investor-owned power companies, and in December, 1945, rose to the position of general counsel.

In 1957 he resigned this position shortly before Arnold R. Jones was sworn in as a member of the TVA board. The new member tipped the balance of control on the board from Democrats to Republicans.

"The new board, as I see it, is entitled to a man in this particular position who sees things their way," Swidler said at the time.

Unlike many other top TVA officials who left the Authority, Swidler decided to stay in the Tennessee Valley.

He left Knoxville in 1957 and set up a law practice in Nashville. His clients have included the Tennessee Municipal League, the cities of Jackson, Memphis, and South Fulton in Tennessee and Paducah and Princeton in Kentucky.

He is general counsel for the Tennessee Rural Electric Cooperative Assn and has advised several of the member cooperatives on occasion. He has also been retained by the Alabama Rural Electric Assn on power control matters.

Swidler has served as consultant to the House Committee on Public Works in connection with the formulation of a bill which would broaden the basis for justification of federal water control.

In 1957 he served for a short time as consultant to a United Nations task force studying the integrated development of water resources in the international field.

Within the past few weeks he was sounded out on the lower political levels to see if he would accept a position on the TVA board. He reportedly turned this down, but when questioned declined to comment on it.

In representing Paducah, South Fulton and Princeton, Swidler helped obtain TVA power for all three cities. In Jackson he has been working on obtaining TVA tax equivalents for the city. In Memphis last spring he helped negotiate a contract which calls on TVA to supplement city-owned power during the summers of 1962 and 1963.

"We know he is consumer-minded and will straighten out that mess up there in Washington," said Ray Morton, president of the Memphis Light, Gas & Water Division.

In court, Swidler appears to be complete master of the situation. His manner is dignified but not belligerent. He is at his best when he is arguing a point for public power, putting to work the resources of a lifetime of study.

The Nashville *Tennessean*, which throughout the years has been one of the most vocal supporters of public power, and Sen Estes Kefauver, always a staunch public power and TVA defender, congratulated the government and Swidler on the appointment.

Swidler told *Electrical World*: "All the views I entertained as a private citizen will need to be re-examined in the light of a position of administrative responsibility, just as a judge, who may have had an opinion on a lawsuit as a layman, would have to look at it in a very special way from the bench."

Swidler said this attitude will particularly govern his views on power questions. Here are some of the ideas he has expressed in meetings of the American Public Power Assn at New Orleans in 1958 and in Seattle in 1959:

- "I do not advocate universal public ownership in the electric power field. I am in favor of the present dual system of part public and part private ownership. This dual system is good for the private utilities, good for the public systems, and above all, good for the public . . .
- "The consumers of the private electric companies owe a great debt to the public systems, because it has only been the need of the private companies to measure their performance against that of the public systems which has provided the necessary stimulus to the private companies to do an effective job.
- "When power company spokesmen talk about 'freedom' and 'free enterprise,' which they do, endlessly, and in a proprietary way, what they mean is freedom to destroy the public systems, and to deprive the communities of America of the right to carry on a vital public service for themselves, that is, as a public enterprise.
- "In my definition, freedom in the power field means freedom on the part of the citizens of each community in the country to make their own decision on whether to operate their electric system for themselves, or whether to entrust this responsibility to a private company.
- "There have been numerous proposals for a nationwide power grid under federal auspices which would provide a generating and transmission system interconnecting and coordinating the various regional supply pools, and providing to municipal and cooperative systems an opportunity to share in the benefits. Such a grid is a long range objective to which all public power supply systems look forward and which we would all support. Whether and when it will be achieved is problematical."

R. B. GEAR

C. H. LINDER

J. M. WARNER

W. W. SHEW

Purchasing Agents Want

Manufacturers ask for cooperation, high bidding ethics, and more consideration for research and development cost

Utility purchasing men meeting in Detroit last week heard repeated pleas for aid in stabilizing what was described as a chaotic electric equipment market. At the annual midwinter conference of the utility buyers' group, the purchasing agents heard two top manufacturing executives and the publisher of *Electrical World* ask their cooperation in putting the market on a sounder basis.

Adding a backdrop to the buyers meeting were frequent news reports from Philadelphia telling of sentencing of antitrust violators in the electrical equipment cases.

Many of the defendants in the Philadelphia cases had been regular attenders at the buyers' conferences and one had a prime spot on last year's program. The reports of the sentencing formed a backdrop for several of the main speeches at the Detroit meeting. Observers recalled that the equipment market had broken on the heels of the grand jury investigation in the Philadelphia cases.

Pleas to the buyers for help in strengthening the market took several forms. W. M. Wallace, vice president of Allis-Chalmers Manufacturing Co, asked simply for cooperation.

Clarence H. Linder, vice president and group executive of the electric utility group of General Electric Co, asserted that buying decisions based on price alone can put economic pressure on a single spot in the economy to the detriment of the whole economy. He also said that utility buyers are in a pivotal position to determine whether research and development in the equipment field can be carried on at the levels of the past few years. But Linder had no quarrel with the utility purchasing men for being cost-conscious. "A strong cost-consciousness must be a way of life," he said.

To meet today's utility requirements, Linder said, General Electric had put into effect a mass cost-reduction program in its production of equipment. He pointed to the labor contract negotiated last fall as an important keystone in meeting the pressure of inflation. He said his company is surveying and reviewing customers' wants and needs, and attempting to optimize products to meet those needs.

EW Publisher Warren W. Shew urged the purchasing men to give close consideration to the recommendations set forth in Detroit Edison Co's "Purchasing Department Information Booklet." Among the specific suggestions:

- Deal fairly—avoid favoritism and make each transaction both a good buy for the company and a satisfactory deal for the seller;
- Don't bargain with suppliers—get each bidder's best price on his first quotation and don't ask a vendor a second quotation on a particular purchase or to meet a competitive bid;
- Keep prices confidential—do not tell a vendor what prices are being quoted by competitors.

Shew also had a few suggestions for the suppliers, heavily represented in the audience at the buyers' meeting. Among his suggestions:

- Don't take undue advantages of your geographical location to push reciprocal buying in times like these;
- Don't discriminate in pricing your products to utility customers;
- Have the courage to set prices and hold them until the market gets a chance to know about them;
- Speak frankly of your pricing policies to your customers;
- Get over the idea that there will ever again be a seller's market.

In a broad gage description of the current utility market, Shew said it was one with "low prices," a considerable overcapacity of production on the part of the manufacturers, of "cut-throat" competition among manufacturers, and one in which foreign manufacturers were seeking to get a foothold in the US utility market.

In his discussion of excess pro-

Stability in the Electrical Market

duction capacity, Shew said, "I am convinced that there is capacity to produce for your needs for the next five or more years. In fact, in many product lines only two or three manufacturers could supply all your needs easily merely by means of a second shift and a little subcontracting." Shew estimated there may now be sufficient plant capacity to produce up to 20,000 Mw of turbine generators and as much as 100,000 Mva of power transformer capacity.

Seeking More Members

Buyers' Group Chairman Robert B. Gear, director of purchases for Commonwealth Edision Co, opened the meeting with a reiteration of buyer's group policy and a plea for increased membership in the group. But he urged that the group continue to limit the number of suppliers who may attend the group conference.

John M. Warner, purchasing agent for Philadelphia Electric Co, presented a paper which sought to evaluate the savings in equipment costs as they may affect the stockholder and the ratepayer. In his example which isolated the 5% savings on $1-million worth of transformers, Warner indicated that with normal utility financing and depreciation practices the stockholder might realize a 10% increase in earnings on the 5% savings. Or, if the savings were reflected in lower rates, each dollar of savings might result in $3.86 to the ratepayer over the life of the equipment.

Warner said that utilities might make such equipment saving by availing themselves of larger capacity equipment through interconnections, or by more standardization of large equipment so that repetitive manufacture would be possible.

In discussing the manufacturers' contributions to today's utility system, Earl Ewald, vice president of Northern States Power Co, said that the cost of a modern 183-mw turbine generator runs about $125 per kw complete. It produces a kwhr from about ¾ of a lb of coal. Ewald said this compares very favorably on a kw basis with a 35-mw unit installed 35 years ago. The old unit also cost about $125 per kw and required 1⅓ lb of coal to produce a kwhr. The older, smaller unit required about twice the number of operators as the new unit, he said. "This illustrates graphically how the combination of research and development, improvement of methods, and growth have combined to make it possible for us, after 35 years in which prices have increased three times and wages have increased five times, to install a kw for the same capital cost and produce kwhrs at even lower operating costs," Ewald said.

The Northern States vice president continued, "This same analogy carries over into other phases of the electric business and throughout the gas utility as well. A typical transformer in 1930, such as a 37.5-mva unit, cost about $2.20 per kva. Today we can buy a 285-mva transformer for about $1 per kva. A transmission line of 230-kv costs less than twice as much as one of 115 kv but it carries four times as much load so the unit cost is substantially less."

In the only on-stage reference to the antitrust cases in the electrical equipment field, Ewald offered this observation: "The referee has put the flag down on the field. If a penalty is taken, we know that we will continue the game with the same spirit as before."

In a brief paper discussing ethics in purchasing, Louis H. Moss, purchasing agent, New Orleans Public Service Co said that purchasing executives should be careful in the selection of procurement personnel for their departments. "You should seek individuals whose honesty and integrity are unquestionable, whose soundness of character and moral principles are above reproach," Moss urged.

In dealings with manufacturers, Moss said that the utility purchasing agent "must treat all quotations in a confidential manner—never revealing prices to a supplier's competitor. Permit only one quotation from each supplier and be certain that each quotation is received by a specified date and time. The buyer should buy without prejudice and promote honesty and truth in buying and selling."

Reporting on a sample survey on invoices, W. C. Allen, manager of purchasing and stores for Utah Power & Light Co, indicated that the most frequent complaint brought by utility purchasers against supplier invoices is that the paper is not suitable. More specifically, the PA's argued that the invoices did not hold up either for microfilming or for storing.

There were also complaints that information on invoices was either difficult to locate or illegible. In concluding his remarks on invoices, Allen said, "I believe the solution to our problems with "invoices" lies in exposing our complaints to suppliers and by showing them examples of what we believe are the minimum requirements of an acceptable invoice. I am sure they will be just as glad to modify the form and content of their invoices to accommodate our needs as we will be glad to achieve a broad and lasting improvement in the entire field of invoice processing."

In a discussion of vendor stocking of materials for utilities, D. J. Fitzgerald, purchasing agent, Baltimore Gas & Electric Co, said that two years of experience with vendor stocking had brought a few second thoughts. Instead of requiring the warehousing to be within the utility territory, Fitzgerald said his requirements had been somewhat relaxed to permit stocking outside his territory, but still within distance that would make overnight delivery of materials possible.

Allan W. Fox, manager of purchases for Puget Sound Power & Light Co, in a discussion of "Steel vs Aluminum," reported use of aluminum in a number of new transmission towers and substation structures. He concluded "that due to advances in metallurgical developments, new freedoms in design concepts, ingenuity in fabrication, reassurance of modern testing facilities, and adequate erection engineering to meet all of these, we as purchasing men may assure our engineers and our management that both aluminum and steel are prepared to meet the economic challenge of growth."

Best OH

Installation of a 30-ft pole, transformer, line arm and service drop is accomplished most quickly by using a 3-man line truck with a digger attachment. This was demonstrated to utility men at a Work Measurement Workshop held recently at the Cleveland Electric Illuminating Co.

Three different methods were used:

- Two-man digger and four-man line crew.
- Three-man digger and three-man line crew.
- Three-man line truck with digger attachments.

The summary of the minutes required by each method is shown in the table. The standard man-minutes figure for the job was determined previously by time study techniques.

Job data were taken from Multiple Activity Charts (see opposite).

References are made on chart to certain "p" designations. The meanings are—"p-3," crew balance (one or more members of crew held up waiting for others); "p-4," receiving instructions; "p-6," transportation to and from the job; "p-7," transportation on the job (walking to get something); "p-8," fatigue; and "p-9," personal time.

Analysis of the Multiple Activity Chart reveals that there are few times when all members of the crew are working. Although the improvements in crew balance on the

Time Comparison—Overhead Lines Experimental Job

(Job Description: Install Pole, Transformer, Line Arm and Service Drop)

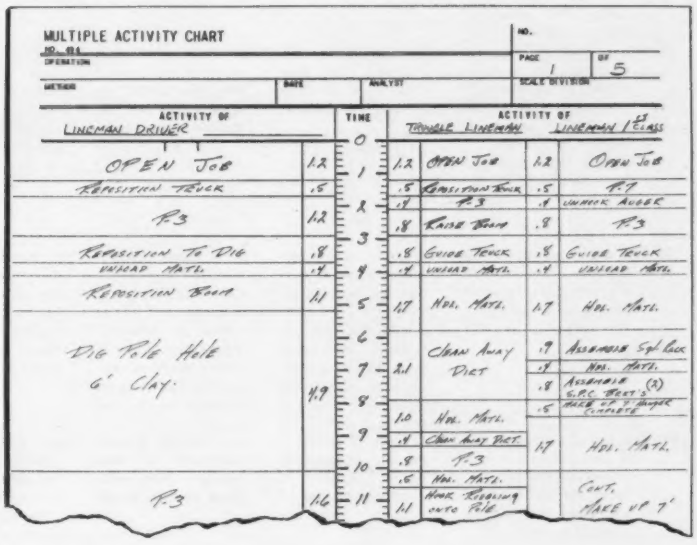
	Two-Man Digger and Four-Man Line Crew		Three-Man Digger and Three-Man Line Crew		Three-Man Line Truck With Digger Attachments		
	Actual Man Minutes	Percent of Total Time	Man Minutes	Percent of Total Time	Man Minutes	Percent of Total	Standard Man Minutes
Work	437.5	74.8	315.3	89.9	271.7	84	447.6
Crew Balance (Forced Delay)	147.3	25.2	35.4	10.1	52.3	16	182.4
Total	584.8	100%	350.7	100%	324.0	100%	630.0
Performance	112		180		195		

$$\text{Performance} = \frac{\text{Standard Man Minutes}}{\text{Actual Man Minutes}}$$

Construction Methods Shown

test is somewhat unreal because of the controlled conditions, the reduction in working man minutes is a clear indication of the superiority of the three-man line truck with digger attachment.

One change has already been made in CEI procedure as a result of the work measurements program. No line foreman is assigned to a three-man line truck. The previous four-man line crew was made up of a line foreman, a first-class lineman, a second-class lineman, and a driver-groundman. The new three-man crew is made up of a first-class lineman-leader, a second-class lineman, and a driver-groundman. Each foreman works three or four crews, traveling in a company car.



Five Companies Compare OH Construction Procedures

At the Work Measurement Workshop five companies revealed their techniques for organizing line crews, preparing jobs and other construction and maintenance duties. The companies range from about 1,000 Mw to 3,500 Mw of generation, both largely-urban and largely-rural systems being represented.

	Company A	Company B	Company C	Company D	Company E
1. Do you pre-estimate man-hr for line construction, maintenance, and operating jobs before jobs are assigned to crews?	Some	Some	All construction, some operating and maintenance	Some	All
2. Do pre-estimates cover:					
(a) Man-hrs?	Yes	Yes	Yes	Yes	Yes
(b) Travel time?	Yes	No	Yes	No	Yes
(c) Forestry man-hrs?	Yes	No	Yes	No	Yes
(d) Overall time hdq to job and return?	No	Yes, only on customers cost work	Yes	No	Yes
3. If only some jobs are pre-estimated, what is the basis for selection?	Costs a minimum of $2,000.	All pre-estimated except for emergency, trouble, and trouble maintenance	Operating and maintenance jobs selected on basis of size of crew and material involved.	Man-hour requirements and type of job. Services, meter and transformer changes up to 50 kva require no estimate. All others estimated.	All jobs pre-estima ed
4. Are service jobs (service drops) pre-estimated?	Only when a part of other estimated work.	Yes	Yes	No. Service orders are given 3-man crews. No. 2 or larger estimated, may be done by line crews.	No. All service work is done on a "Blanket Work Order"
5. Are all jobs inspected in the field before job lay-out and order is prepared?	All, with minor exceptions made to expedite specific "rush" jobs.	Some. Jobs requiring any engineering are field inspected.	About 85% inspected. Construction jobs, customer jobs, and some maintenance and operating jobs are inspected.	All jobs inspected before estimate is prepared, except services less than No. 2 and transformers under 50 kva.	Most jobs are field checked. Only transformer changes, etc., are not.
6. Who prepares job lay-out and order to do work?	Line estimateman prepares layout for large commercial, road jobs, system improvements. Extension representative prepares lay-out for domestic and small commercial.	Surveymen do all lay-out work. Jobs exceeding 50 Kw are reviewed by an engineer.	Engineering determines routes and electrical requirements. Overhead Lines Estimator issues department order covering layout, material and labor.	Engineer prepares rough layout of voltage, wire size, switches, transformers, etc. An estimator adapts to field conditions, prepares instructions, plans, material lists, etc.	Both engineer and engineering technician

	Company A	Company B	Company C	Company D	Company E
7. Who pre-estimates man-hr requirements for jobs?	Engineering technician	Engineering technician. Estimator on customer cost and large feeder jobs.	Engineering technician	Engineering technician	Both engineer and engineering technician
8. Do orders include pole setting, or removal, line work, forestry, etc.?	Yes	Yes	Yes	Yes	Yes
9. When a crew finds it necessary to perform routine maintenance in connection with a construction job, are maintenance man-hours counted separately from construction man-hours?	Yes. Man-hours are charged on time sheet direct to maintenance job number.	Yes. Entries on time sheet reflect amount of time spent on construction and on maintenance work.	Yes. By charging labor and material involved separately on time reports and requisitions to maintenance work orders.	Yes. Man-hours for maintenance in original estimate basis to distribute actual man-hours to accounts. Additional maintenance distributed on the basis of estimate and adjusted after completion.	Yes. The foreman charges hours to the appropriate maintenance accounts on the "Daily Time Report."
10. Are crews permitted to deviate from the job layout? If so, to what extent are man-hour pre-estimates revised?	Yes. Changes are permitted when authorized by field supervision. Pre-estimates are not revised. Man-hours from change used to explain difference between estimate and final cost.	Yes. If minor changes involved, crews make necessary changes and no revision of pre-estimates are made. If major changes necessary, job papers re-engineered and re-estimated.	No. However, deviations may be made by obtaining approval from estimator who adjusts material- and man-hour pre-estimates.	Yes. Crew foremen must obtain permission of estimator or engineer for any except minor changes. Estimates revised after job completion if man-hours exceed allowable differences.	No. This is not permitted unless foreman consults the district engineering department.
11. Are actual man-hours for a job compared with pre-estimated man-hours for the job? If so, when is this comparison made?	Yes. Over $10,000—as job progresses. Under $10,000—upon completion of job.	Yes, after job is completed for cost comparisons and work measurement analysis.	Yes. Comparison of actual time and costs to estimates made by Accounting Dept after job completion. Comparisons by job, by crew, and by district are sent to Lines Dept.	Yes. IBM report is prepared monthly of jobs completed showing total man-hours estimated, total actual man-hours, difference and percent of actual to estimated.	Yes. This comparison is made monthly to determine overrun or underrun in comparison with budgeted estimates.
(a) If comparison is made, what is considered an allowable difference between actual and pre-estimated man-hours?	10% of net expenditures is used in explaining difference between estimated and actual costs. Man-hours are not used.	.....	When a difference between the actual material installed or removed exceeds the following tolerance, it must be explained by foreman: 201–1000 ft—25% Over 1000 ft—10%	For accounting adjustment, under 40 man-hours or 10% for jobs of 400 man-hours. Department control uses sliding scale from 2 man-hours for jobs up to 9 man-hours, to 10% over 100 man-hours.	A total overrun or underrun of 10% or $1000 is allowed on all material, labor, etc.
(b) If the actual man-hours exceed the allowable difference from pre-estimated man-hours, what action is taken and when?	Over $10,000 — attempt is made to keep actual and estimated costs in line as job progresses. Under $10,000—difference is used as an explanation upon completion of job.	If the cost comparison exceeds 10%, letters are written explaining overrun and underrun.	A cumulative record is maintained of the estimated and actual man-hours for work completed by each foreman. When foremen continue to be out of line on a 6 to 12 month cumulative basis, their performance is carefully reviewed by the superintendent.	After job is completed, original estimator re-estimates labor based on actual material. Actual man-hours then distributed based on the re-estimate. If redistribution changes any account over 19 man-hours, all charges are cancelled and new distribution substituted. When caused by inaccessibility, mud, inexperienced crews, etc., no adjustment is necessary.	If total cost exceeds the limitations mentioned in 12 (a) above, it requires superseding of the authorization with appropriate approvals.
12. Are pre-estimates used to distribute actual man-hours?	No	No	No	Yes	No
(a) If yes, do you adjust for jobs not completed within month?				No, adjustment is made only after job is completed.	
(b) If no, how are the actual man-hours distributed?	Charged direct to accounts daily. Testing engineered time standards as basis of distributing actual man-hours.	Charges are accumulated until job is completed and then distributed to the various accounts involved.	On the basis of time standards for units of material installed.		Foreman charges actual hours under "Plant Installation" or "Plant Removal". Maintenance does not get into job.
(c) If a job continues for an extended period, when and how are actual man-hours distributed to accounts?			Construction accounts charged with labor and material until job completion. Completed costs transferred to primary accounts, based on time standards for material.	Pre-estimate of man-hours is used as basis to distribute actual man-hours for entire job. Any adjustment in accounts found necessary is made after completion of job.	

	Company A	Company B	Company C	Company D	Company E
13. Are orders for storeroom material prepared for line jobs?	All	All	All	None	All
If none, how is material provided field crews?				Crew orders material in excess of truck stock from estimates.	
14. Do orders include all materials for each job or only major items?	All	All major items and non-truck stock small items.	All	Major items. Minor items usually carried as truck stock.	Orders for materials include all items of a reportable nature.
15. Who prepares the orders for material?	District clerk prepares store orders upon request.	On jobs with engineering sheets, estimater orders material. On jobs without, surveyman orders.	Overhead Lines Estimator.	Prepared by crew based on material estimated.	Storeroom orders are prepared by the foreman assigned to the job.
16. Are line trucks equipped with a standard load?	Yes	Yes	Yes	No	No
(a) If yes, is it part of storeroom inventory?	Yes	No	No		
Who is responsible for truck stock?	Field crew	Field crew	Field crew		
(b) If no, what type o material is carried on trucks regularly?				Materials determined by crew based on work usually done. Each truck charged with material received and credited with material installed or returned.	Minor items of material such as connectors, bolts, etc., and also items which are usually necessary to do emergency work such as cutouts, arresters, etc.
17. Are trucks loaded with all materials for jobs assigned to crew:					
(a) By special loading for job?	Yes	Yes	Yes	Yes	
(b) By standard plus special items?	No				Yes, (normal load plus list of special items)
(c) By standard load?	No				
(d) By some other method?	All material charged to truck stock. In a few cases charged direct to job when withdrawn from storeroom.				
18. Who loads materials on the line trucks:					
(a) Night loaders?	Yes, at central storeroom only.	Yes	Yes		Yes, in one district only.
(b) Regular storeroom day personnel?	No	Yes			
(c) Field crew personnel?	Yes, at district distribution centers			Yes	Yes, in 13 districts.
19. Are materials charged out of inventory:					
(a) When loaded on line trucks? Who prepares disbursement order?	No	Yes Debits by estimator or surveyman. Credits by field personnel.	Yes Estimator list tabulated and sent to Stores Dept.		Yes The foreman in charge of the job.
(b) When they are used on the job? Who prepares disbursement order?	Yes Crew chauffeur prepares daily report of material used or returned.			Yes Truck driver, signed by the foreman	
20. Are delivery trucks used to supplement the material on line trucks?	Yes	Yes	No	No	No
21. Are work sketches prepared for all line construction assigned to crews?	Some	All	All	Some	Some
(a) If sketches are prepared only for some jobs, on what basis?	All jobs have sketches except those involving minor maintenance.			Sketches for all estimated jobs. Services less than No. 2 meter changes, and transformers under 50 kva not estimated.	Extent of construction and right-of-way requirements.
22. Where sketches are attached to job orders, can changes be made by field crews?	Yes	Yes	Yes	Yes	No
(a) If yes, to what extent?	Major changes with permission of field supervision. Minor on authority of foreman.	Minor changes only. Major changes require re-engineering.	To conform to field installation requirements as approved by estimator.	Crew foreman must get permission of estimator or engineer except minor changes.	
(b) If no, what disposition is made of the job?					Minor change can be made by District Engineering office. Major change requires a revision.

Technical Problems Are Main

Further improvement in batteries, control systems, and body design required

The outcome of a wide range of current research and development efforts, ranging from pure science studies on battery electrodes to production refinements on components and systems, may well determine the electric vehicle's future. Is it to be limited to special, low-range, low-speed applications, such as dairy and bread routes or meter reading or are there real prospects for mass production as a second car for in-town or even highway use?

In the brief interval since the electric car reappeared from the past, manufacturers and researchers have been working all along the line to overcome some of the barriers in energy limitations, system losses, and excessive weight. But many problems remain.

To become a practical means of transportation, the electric vehicle and most of its components must be designed specifically for street and highway travel. Gasoline vehicles converted to electric drive lack the efficiency, speed, or range to make them practical.

The principal design requirements for a successful electric vehicle are minimal component weight and system loss, a design adaptable to volume production, and performance and operation at least equal, in the intended application, to gasoline vehicles. Total cost, including first cost, operation, and maintenance, must be less than that of a gas vehicle for the same job.

Seeking electric vehicles competitive in performance and cost, designers must push materials and components to their limits. To cut weight, for example, designers are planning lightweight aluminum or Fiberglas bodies. But gas-engine car designers have the electric car men at a disadvantage at the outset because they have leeway in which to work. Gas-engine cars have mass production working for them, customers who don't demand absolute minimum cost and a versatile power plant the driver doesn't use to capacity.

The electric car designer must compute energy requirements for various conditions, always taking into account the effect of wind resistance. For instance, a car similar to the Volkswagen Kharmann Ghia, a 1,200-lb car with low wind resistance, carrying two passengers with a 300-lb combined weight, has an overall efficiency of 74% (82% electrical; 90% mechanical). Accelerating from zero to 40 mph in 30 sec would call for an additional 10.8 kw from the battery. Or, it takes 0.09 kwhr for acceleration alone, each time one accelerates from stop to 40 mph.

The designer must accurately measure the effect of total weight on required horsepower for different level-ground speeds of a small passenger car. For instance, reducing road weight from 2,200 to 2,000 lb (10%) decreases required horsepower from 6.6 to 6.3 hp (5%) at 40 mph. But weight has its effect on acceleration and grade operation as well (see box below).

To compute the application of electric motors, the electric car designer must know total vehicle weight, maximum level mph, motor torque on level, maximum expected grade percents and lengths and the expected duty cycle. Typically, series motors, well-suited to traction work, would be used. These give smooth starts, have definite speed droop, with increased load, and give high torques with relatively low current and relative independence of applied voltage.

The motor should be as highly efficient as possible, to reduce battery drain. For the same reason, it is essential to size cables liberally and to keep control resistance out of the armature circuit.

The problem encountered with the battery is getting a unit of proper storage capacity and low weight to give the range required. Once the battery engineer

Basic Traction Laws Pose Stiff Problems in Electric Design

Traction engineering as such is a well-developed science. Mechanical torque required at the motor shaft is a function of vehicle road weight, grade percent, speed, acceleration, effective wheel diameter, gear ratio, and mechanical efficiency. It can be expressed thus:

$$T = \frac{D}{2Re}\left[W(C_1 \cos \tan^{-1} b + \sin \tan^{-1} b + C_2 A) + C_3 a v^2\right]$$

where T is torque in lb-ft; D is effective wheel diameter in feet; R is gear ratio; e is mechanical efficiency; W is total road weight in lb; b is grade percent; a is effective frontal area in sq ft; A is acceleration ft per sec^2; and v is velocity in ft per sec. C_1, C_2 and C_3 are constants. In the above equation weight is brought out of the parenthesis to show it is a directly proportional factor in three of the four terms of the torque equation.

Examining the four terms:

- $WC_1 \cos \tan^{-1} b$ is rolling resistance in lb, the retarding force of friction. For all intents, it is constant for a given car weight and a road surface. Grade factor on most reasonable grades doesn't affect it. Thus the variation in rolling resistance from level to a 10% grade is about ½%. But the constant, C_1, is important: quite low for smooth concrete roads, quite high for loose sand—or low tire pressure.
- W sin tan $^{-1}$b is the grade resistance, the retarding force resulting from hill climbing.
- WC_2A is the retarding force that must be overcome to accelerate. C_2 actually is 1/g, where g is 32.2 ft per sec^2.
- Velocity doesn't come in until the final term, but there it is squared and multiplied by the effective frontal area in the determination of air resistance. This is the factor which makes streamlining so important above around 30 mph.

Torque times rpm is power, so three of the four terms in the power equation are a direct function of speed. The fourth term, air resistance, is proportional to the cube of speed.

Barrier to Wide-Use Electric Car

has the motor curves and required torques, he can easily calculate the amps and volts needed. He uses his data on initial and final battery voltages versus time, when discharging at various currents, to select the proper amp-hr capacity of the battery. He factors in the loss of capacity on lower temperatures. He uses the most economical combination of battery weight and capacity to maximize the range.

A 1,200-lb curb weight vehicle, to get a top speed of 60 mph and a 180-mile range, needs a 600-lb battery requiring a 67-whr per lb battery output. At 40 mph maximum, a 180-mile range would require a storage density of about 50 whr per lb.

Because present heavy-duty ignition batteries (giving 14 whr per lb) last only a year or two in propulsion service, battery designers recommend industrial batteries. But the best of these run only about 10 whr per lb, though they soon may approach 14, enough for a 50-mile range at 25 mph with constant discharge.

Prototype automotive batteries being tested will deliver about a 50-mile range at a 20-mph constant speed. Lead-acid batteries up to 18 whr per lb may be in the offing, and they should give a 75-mile range at a constant 37-mph speed. Thus present batteries of suitable cost, weight, and dependability will satisfy only limited city driving needs.

Today there are commercial batteries capable of up to 60-whr-per-lb density. This would permit, for example, a 1,200-lb car to travel 200 miles at almost 50-mph constant speed. But price is prohibitive on this sort of specialty job, and life short.

Significantly, the energy per lb of the best of these is still far below that of gasoline, which can provide about 1,500 whr at the engine output per lb of its own weight. The typical 13 gal of gas removed in converting a small car to electric would provide energy to give the total weight removed (about 700 lb) an energy density of 200 whr at the engine output per lb. This weight is replaced by battery, motors, and controls, with a density of about 8 whr at the motor output per lb.

The average homeowner might be restricted by circuit limitation to as long as 16 hr for recharging, even though designers claim complete recharge can be done in about three hr, or a 75% charge in an hr. A system of exchanging standardized batteries at service stations or having power connections in parking meters would have to be devised.

Another major consideration would be the control system. Until recently a foot-pedal controller operated contacts to place battery sections in series or parallel, to change resistance in the armature and field circuits, and perhaps to switch field circuits. But in the present application, this simple dc motor speed control complicates connections, gives excessive losses, and poses excessive contact wear hazards.

Two recent control approaches are novel:

• A rotating device like a dc machine, with two sets of brushes, one linked to the foot pedal. The pedal position decides the angular distance between the two brush-set axes. Voltages input is from the battery; voltage output is proportional to the angular difference. This controller is used with a shunt motor, and regenerative breaking, when the motor voltage overhauls the battery voltage, is permitted.

• **A pulse-time control.** A controlled silicon rectifier passes current when initially "gated" by a special control circuit. A capacitor circuit reduces the rectifier's voltage when the capacitor is sufficiently charged, a constant interval after start of current flow. Since the gate-control device can generate pulses with controllable frequency, battery voltage is applied to the motor in a series of square waves pulses of constant width but varying rates. Average motor voltage and speed are direct functions of the controlled pulse rate. Motor current, on the other hand, is sustained during the off-periods by inductance in the circuit. Therefore, motor power is also a direct function of the controller pulse rate. No regenerative braking is possible with the circuit now in development.

These circuits use only reversible contactors for shifting. Since no resistance is used in main circuits, losses are minimized. And connections are simple. If price, weight, and reliability are suitable, the control problem may be overcome.

Regenerative braking, a controversial issue, would provide foot-off-the-pedal drag common to high-compression gas engines, giving similar safety and low wear on braking surfaces. And, by returning energy to the battery, battery range would be extended.

Fundamental Battery Research Needed

BRIAN E. CONWAY, Associate Professor of Chemistry, University of Ottawa, Canada

An ideal battery would be one from which a maximum of electrical energy could be drawn at relatively high rates from the minimum weights of electro-chemically active material; that is, the ratio of electro-chemical capacity to weight should be maximal. This is particularly desirable where the battery is used as a source of motive power in an electric vehicle.

From a chemical point of view, two factors should determine the choice of materials:

(1) The electrodes should be such that in a given solution they give rise to the widest difference of reversible potentials.

(2) The elements should be as light as possible. For the "ideal" pair of electrodes, we should therefore look at each extreme side of the early periods of the periodic classification or at each end of the electrochemical series.

In practice this ideal choice of materials is rarely satisfactory and

various compromises must be made, particularly if a battery approaching reversibility is to be constructed. Thus, instead of making the positive electrode an electronegative element such as fluorine or chlorine (in contact with a catalytic metal)—obviously impractical in any cell for commercial day-to-day operations—an electrode formed from a highly oxidized metallic compound is more satisfactory. In the charged lead-acid battery, this is lead dioxide; in the Edison battery, a higher oxide of nickel.

Electrode Choice Limited

For satisfactory performance with minimum internal electrode resistance, these oxides should have good electrical conductivity. Most normal oxides of base metals are relatively poor conductors. When a non-stoichiometric electronically-conducting oxide, such as the higher nickel oxide, can be prepared, this is particularly suitable.

Choice of the negative plate is similarly limited. The metal must not be so base (e.g., Na or Li) as to react spontaneously with the electrolyte. Again a compromise must be made in the interests of stability and reversibility. Lead, in the lead-acid battery, and for example, cadmium or iron in the nickel Edison cells, are found to be satisfactory electrode materials.

To obtain good performance-low internal resistance, open-circuit stability, etc., sacrifice must usually be made in the optimum capacity weight ratio. Some values of this ratio have been calculated for the stoichiometric reactions involved in some cells and are given in the table.

Some of the cells shown are hypothetical, and are shown only for comparison with practical cells in common use. Some of the cells which could be formed from the most electropositive and electronegative elements, but which are impractical in aqueous solutions, would be more amenable to use in non-aqueous solutions. For example, sodium and potassium can be electrodeposited from ethylene-diamine solutions of suitable salts, and these metals in such a solution could form the basis of a primary cell with unusually high voltage.

In the table data are included on some more modern and less conventional cells or electrode pairs; for example, the H_2-O_2 pair used in fuel cells where the cell reaction involves ionization of hydrogen at the negative plate (analogous to the Cd plate in the Ni-Cd battery) and of oxygen at the positive plate (analogous to the nickel oxide in the Ni-Cd battery) the net reaction being the formation of water. Such cells are being widely developed and a unit capable of propelling a factory truck has been demonstrated by Bacon (EW, Sept. 21, 1959, p 76). The H_2-O_2 fuel cell is theoretically, from a weight point of view, a favorable one but in practice the necessity for storage and preparation of the gases is a limitation and involves heavy ancillary equipment. Recently the silver oxide-zinc and silver oxide-cadmium batteries have been developed with some practical success. Although these couples were known for some years to give adequate emf's, practical problems of reversible operation have until recently limited their use.

Polarization Studies Needed

Except at very low charging or discharging rates, no practical battery ever performs or can perform reversibly. Conditions must usually be adjusted so that the battery approaches the ideal behavior as closely as possible. For example, the plates should have the lowest possible electrical resistance and the maximum area exposed to the solution; the solution should be reasonably concentrated and have a low ohmic resistance. The phenomena associated with irreversibility of electrode reactions are known as polarization. Minor causes of irreversibility (except at the highest current drains) are the finite internal ohmic resistance of the cell and the potential set up by local changes in the concentration of the reacting ions during charging or discharging. The principal cause is the "activation" polarization (the extra electric potential needed to make the electrochemical reaction at the electrode interface proceed at a finite net rate corresponding to the charging or discharging rate). This type of polarization is connected with the intrinsic slowness of certain steps in the electrochemical oxidation or reduction of the electrode materials, as in ionic discharge or electron transfer at the electrode interfaces. The effects of activation polarization are present in all batteries and in principle cannot be eliminated.

Since the rate of charge or discharge is often very high in a storage battery, it is clear that the polariza-

Battery Basics: Some Definitions

Cycle-life: Owing to irreversibility in various stages of the battery reactions, any real battery will suffer only a finite number of cycles of charging or discharging. The cycle life refers to the number of charge-discharge cycles which the battery can undergo without serious loss (say 50%) of electro-chemical capacity. Usually the cycle life depends on the rate of charging and discharging and the type of electrodes involved.

Electrochemical Capacity: This is the total theoretical charge in amp-hr or Faradays which can be withdrawn from a battery; the effective practical capacity often depends on rate of discharge.

Total "Energy" Content: If the voltage across a battery is measured during discharge, the total energy withdrawn will be the integral of the product of current and voltage over the time of discharge. The energy is conveniently measured in whr per gram or per lb of electrochemically active substance in the battery.

Activation Polarization: This is the term given to that part of the polarization of a battery associated with intrinsic slowness of one or other of the electro-chemical reactions proceeding at the electrodes at which a net current is flowing. It is termed "activated" polarization because the reactions concerned proceed with finite "activation" energy, i.e., the reactants must be "activated" to some minimum higher energy state before they will react.

tion must be minimized. Since activation polarization depends on the surface current density at the electrodes (that is, the current passing *per unit area*), it can be kept to a minimum if the area of the plates is maximized, such as by use of porous sintered metals. Here again a compromise with weight and volume and economic factors must be reached. The activation polarization observed at a given charging or discharging rate is determined by the intrinsic velocity of the electrode reaction, the absolute temperature, and the logarithm of the true internal current density in the cell. This kind of polarization can depend specifically on the type and mechanism of the electrode reactions proceeding at the battery electrodes and on the way these rates of reaction depend on electrode potential. Processes whose rates are markedly dependent on potential will give relatively less polarization at a given current density than those whose rates are less potential dependent. It is therefore of great importance to know in detail the fundamental reactions proceeding at battery electrodes during discharge, charge and "overcharge." It is for this reason that more fundamental work is required on battery electrode systems to give a rational basis for improvement of operating power output, minimization of irreversibility and improvement of cycle life and shelf or open-circuit lifetime.

Ideal Electromotive Force and Capacity to Weight Ratios of Various Electrode Combinations

System	Faradays† per gram* of total electrode materials	Amp. hr per gram of electrode material	Approx. ideal max. emf ‡Volts	Energy rating whr per gram**
$H_2 + \frac{1}{2}O_2$ (KOH)	0.11	2.98	1.23	3.67
$Li + \frac{1}{2}F_2$ (KF)	0.0386	1.035	5.9	6.1
$Na + \frac{1}{2}Cl_2$ (KCl)	0.0171	0.458	4.1	1.88
½(Zn + HgO) (KOH)	0.00709	0.190	1.3	0.247
½(Cd + AgO) (KOH)	0.00847	0.226	1.54	0.348
½(Zn + AgO) (KOH)	0.0128	0.343	1.9	0.652
½(Mg + AgCl) (KCl)	0.00643	0.172	2.55	0.439
½(Mg + AgO) (KOH)	0.0135	0.362	3.4	1.23
½(Pb + PbO_2) (H_2SO_4)	0.00448	0.120	2.0	0.24
½Cd + $NiO_{1.5}$ (KOH)	0.00720	0.193	1.28	0.247
½Fe + $NiO_{1.5}$ (KOH)	0.00722	0.194	1.35	0.261
½(Zn + Cu) (1M $CuSO_4$ + $ZnSO_4$)	0.0155	0.415	1.10	0.456

† One Faraday equals 26.8 amp-hr

* Based on empirical formulae given. The figures for silver and nickel oxides may vary owing to non-stoichiometry.

‡ Assuming standard emfs for the half-cell reactions. With silver and nickel oxides some variations of emf occur depending on the degree of oxidation of the oxide. In general, emfs depend on concentration. Values for actual use in batteries are usually within 0.1 V of the figures given.

** Assuming constant emf during discharge; in practice this is not usually the case owing to polarization effects and the dependence of the EMF of positive plates on charge or oxidation. Actual emf obtainable depends significantly on the discharge rate at high rates.

Studies Show Promise

In any fundamental research on the kinetic or polarization behavior of batteries, it is of great importance that the electrode reactions at each of the two electrodes of the cell be studied *independently* since otherwise no satisfactory interpretation of the polarization behavior of two electrodes of different types in series can be made. Despite this obvious requirement, much of the technological study of batteries has been carried out on whole cells and only in relatively recent years have fundamental kinetic studies with individual half-cell electrodes been performed. An example of the kind of work being done along these lines is that being carried out at the University of Ottawa on the reactions involved in the charging and discharging of the nickel oxide electrode of the nickel-cadmium battery. The aims of this work are to characterize the slowest reaction(s) involved in the overall electrode processes, establish the dependence of the rates of these reactions upon electrode potential and to investigate effects of temperature, solution concentration and additives on the kinetics of the reactions. Similar work is in progress elsewhere on lead and silver electrodes of corresponding batteries. Such studies are now well beyond the empirical stage and sufficient fundamental work has been done on the general theory of electrode reactions to make such work on battery electrode systems immediately profitable.

For ruggedness and low initial cost, the lead-acid battery is difficult to supersede. However, it suffers from the disadvantage of limited cycle life owing to irreversibility in the formation and oxidation and reduction of lead sulfate crystals, and relatively low energy rating per unit weight; thus, it is not the best choice for use in electric vehicles. The nickel battery gives about the same energy rating as the lead battery (See table) but has a very much longer cycle life and operates better at low temperature since its emf increases with decreasing temperatures while that of the lead battery *decreases*. More recently, silver oxide-zinc and silver oxide-cadmium batteries have been produced in forms which give satisfactory cycle life and initial problems arising from internal short-circuiting due to growth of metal dendrites appear to have been largely overcome. However, initial costs tend to diminish their value for widespread use in non-specialized applications. Although the H_2-O_2 fuel cell was described as early as 1839, only recently has a modern development by Bacon shown sufficient promise to be used in an electric truck. However, weight of high pressure fuel containers limits general applications at present.

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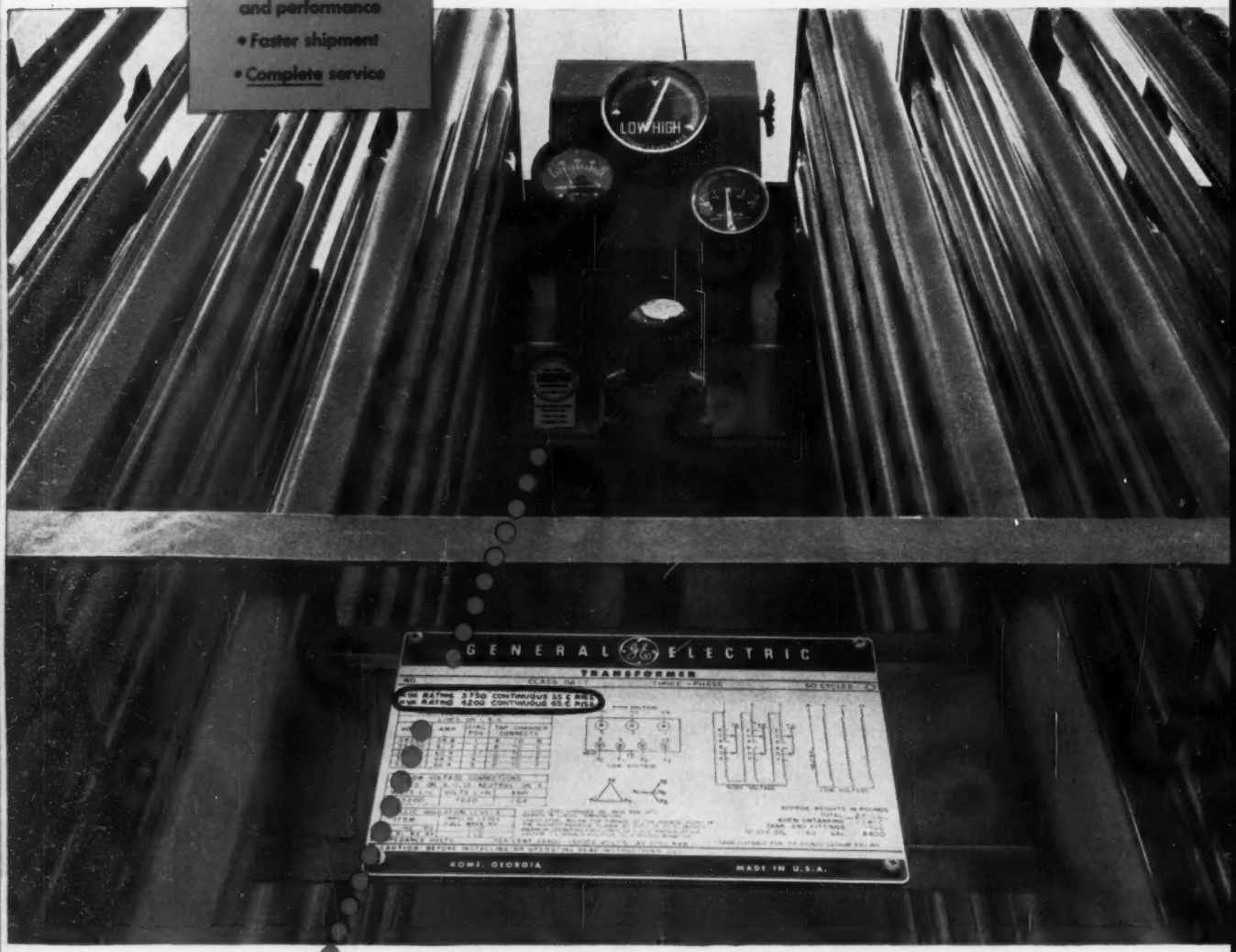

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continuous loadability

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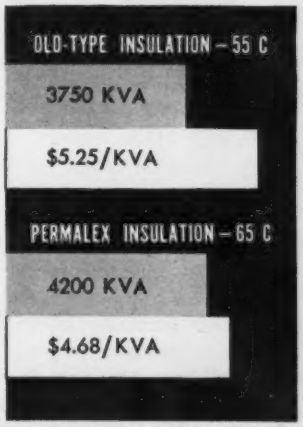
Now, as standard on all medium transformers**, and at *no extra price,* General Electric uses Permalex insulation . . . a system permitting transformers designed for 55 C rise to operate at 65 C rise with 12% more continuous capacity!

For example, a 3750-kva, 55 C transformer with Permalex will operate at **4200 kva,** 65 C rise with normal life expectancy. Or, if you prefer to operate the unit at 55 C, you can expect five times the life of present insulating systems! Fan-cooled rating increments remain the same and can be applied at the 65 C operating condition. Also, Permalex is *completely compatible* with everything in the transformer.

The Permalex system used in General Electric medium transformers features Formex† wire and cyanoethylated paper insulation. Formex insulated wire offers exceptional dielectric strength, outstanding thermal stability and high resistance to moisture effects. Cyanoethylation, which replaces many moisture producing molecules with non-moisture producing molecules, raises the thermal endurance of paper and retards the formation of water.

Ask your G-E Apparatus Sales Engineer to point out the many ways you save with Permalex insulated transformers . . . another result of General Electric's *continuing* Certified Full-value Transformer Program. General Electric Company, Schenectady 5, New York. 416-29

* Trade-mark of General Electric Company.
** 501 to 7500 kva, 69 kv and below.
† Reg. Trade-mark of General Electric Company.



PERMALEX INSULATION gives you extra kva at no additional transformer cost. The result is more economically uprated substations because of the lower cost per kva with no increase in transformer size.

55 C Self-Cooled	65 C Self-Cooled	65 C Fan-Cooled
750 kva	840 kva	966 kva
1000	1120	1288
1500	1680	1932
2000	2240	2576
2500	2800	3500
3750	4200	5250
5000	5600	7000
7500	8400	10500

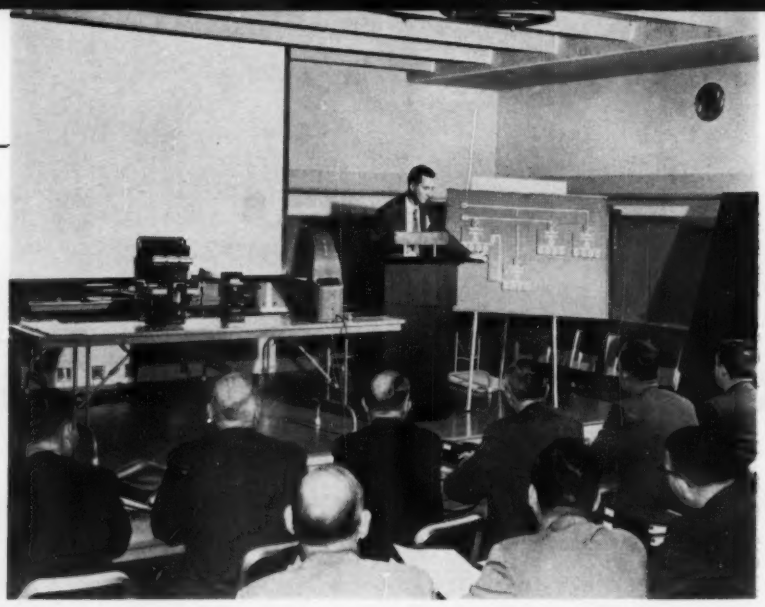
DEFERRED CHANGEOUT of added kva gives more years of operation without extra investment. Real evaluation of Permalex is measured by present worth of capitalized value of deferred investment.

FORMEX TURN INSULATION with cyanoethylated paper insulation provides high dielectric strength, outstanding resistance to moisture and much longer life for medium transformers.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Industrial Power Course Released by IEC



WEST PENN Power Co instructor who helped field test IEC Industrial Power Distribution Course uses one-line diagram to clarify a point

A course developed and field tested by West Penn Power Co with highly satisfactory results has been released by the Industrial Electrification Council. West Penn has presented it to some 500 enrollees in nine areas.

It is the first program to be released by the IEC since its cosponsorship by Edison Electric Institute and National Electrical Manufacturers Assn, effective Jan. 1, 1961.

The course: Industrial Power Distribution Course for sale to electric utilities, electrical leagues and other groups organized to put it on. Purpose: To train industrial plant personnel in the selection of electrical systems and components, to better appreciate the latest equipment, methods and techniques, as well as the advantages of good electrical distribution.

The course can also be used to familiarize industrial power sales engineers, equipment salesmen, jobbers, distributors, and contractors with industrial electric power distribution systems.

The ten, 2½-hr, demonstration-type lectures start with the basic fundamentals of a simple circuit and lead into such subjects as voltage selection and regulation, power factor improvement, protective and control devices, preventive maintenance, system planning, equipment selection, and system grounding.

The course, packaged as a kit, consists of 50 student textbooks and diplomas; two Leader's Guides; 137 slides; "The Busway Story," a 2x2-in. slide kit; and a 3x4-ft magnet book with a complement of symbols and magnets.

Provision is made for the use of four demonstrators, five films, and three sound slide films available on loan from manufacturers. Cost: $400, f.o.b., New York. Extra student texts are available at $2.00 each (10% extra to non-members of IEC).

Write: Industrial Electrification Council, 750 Third Avenue, New York 17, N. Y.

Cleveland May Balk Better Lighting

A section of Cleveland, O, may not get better street lighting because the improved illumination might bring a public clamor for similar lighting in other neighborhoods.

Property owners and businessman along a section of Euclid Avenue have asked the city for improved street lighting, which the owners and merchants would pay through special assessments.

Bronis J. Klementowicz, Cleveland utilities director, said, "Other neighborhoods can't afford it" when told other sections could have the brighter lighting by offering to pay for it. He said that the city has a standard uniform policy for street lighting which meets national levels.

He claimed better lighting was not needed in the area in question because 50 people don't cross the street there in 24 hours, and brighter lighting would be a traffic hazard because drivers would enter from streets with dimmer lighting.

Six new lighting fixtures have been temporarily installed in one area on the avenue. The fixtures give about 5 foot-candles, about twice the illumination of other areas on Euclid.

REA House Heating Booklet Available

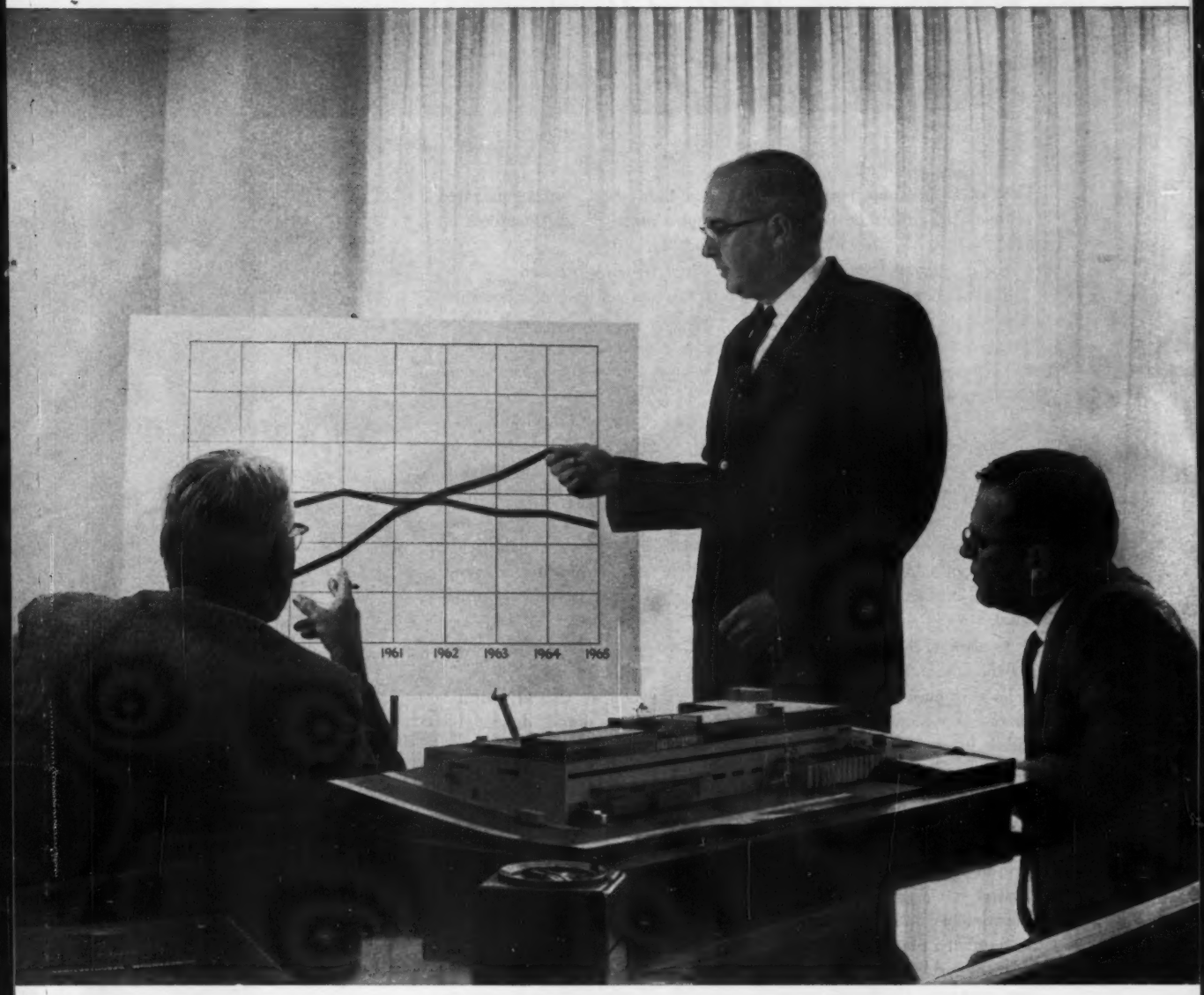
Rural Electrification Administration has revised its bulletin on electric house heating.

Content includes functions of a house heating system; methods of heat transfer; types of electric heating equipment; and estimating heating requirements.

A simplified method for calculating heating requirements has been developed and the booklet provides a step-by-step procedure.

Booklet available from: Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price: 20¢.

Pre-Engineering by **KAISER ENGINEERS** answers basic plant expansion questions...



Profitability? Faced with the decision to expand your plant facilities, you should first determine whether all elements combine to form a pattern of future profitability. Independent analysis of all aspects of your proposed program is the *Pre-Engineering* service offered by Kaiser Engineers. The studies and evaluations furnished by KE Pre-Engineering represent only one phase of total KE services. Kaiser Engineers designs and builds all types of power plants—steam-electric, gas turbine, combined cycle, nuclear and hydro-electric. From Pre-Engineering through design and construction, Kaiser Engineers provides complete one-company service and ingenuity based on years of experience.

KAISER ENGINEERS

KAISER ENGINEERS engineers-contractors
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6229-P

WHAT DO YOU LOOK FOR IN CUTOUTS ?

Most of the cutouts being manufactured today will operate at rated voltage, carry rated current, and interrupt a range of fault currents up to the maximum for which they are rated.

These are basic requirements and cannot be compromised.

But, when you compare the design extras, you get a different picture. Some units are stripped, with little attempt to provide any of the niceties. Others have a few plus features but are short in the critical areas. A very few are solid in performance with a well-rounded measure of the extras.

However, even the most dedicated manufacturer is bound by the laws of economics. No matter how zealous his attempts may be to produce the super-deluxe cutout, costs invariably limit the extent to which extras can be added.

It really boils down to a matter of judgment. The experienced manufacturer, sophisticated in the art of cutout design screens out the frills, avoiding a hodge-podge of specious advantages. His product is sound, reliable, and easy to handle, with margins of safety beyond the minimum.

As always, the buyer must ultimately make the final decision, choosing the cutout with the features he values most highly.

To this man we submit our BV-33-F. We believe that it requires fewer concessions; that it answers his needs for a sound, dependable cutout more satisfactorily than any other being manufactured today. And we point to the fact that these features have been incorporated without compromising any sound design principles.

As one of the oldest manufacturers in this field, Southern States has pioneered and co-pioneered many of the features now considered necessary on a modern cutout. Such things as self-locking hinges, sleet hoods, positive latching, dropout action, non-ferrous live parts, high pressure line contacts, and provisions for easy hookstick handling were standard on Southern States cutouts as early as 1931.

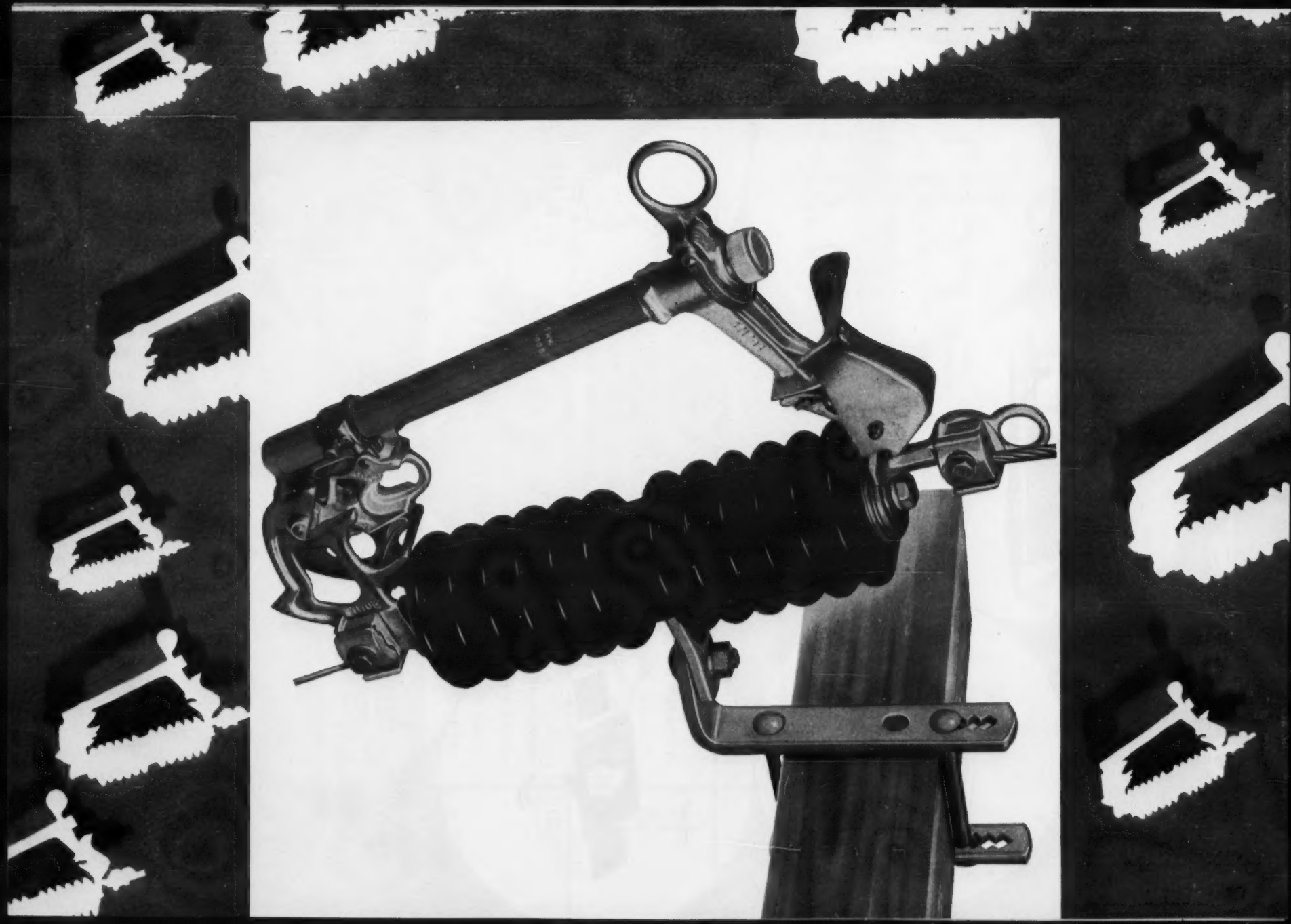
In the last few years such features as the expendable cap, high pressure contacts, 180° tube stops, bird-proofing, improved link ejectors, operating ring for unlatching fuse holder, silver-plated contact surfaces, and clamp type universal terminals have been incorporated.

A careful look at Southern States BV-33-F, can make your decision easier when choosing a cutout.

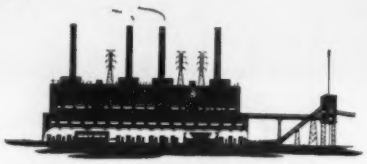
We welcome your inquiry. For details on this unit refer to Bulletin 580C or check with our representative.

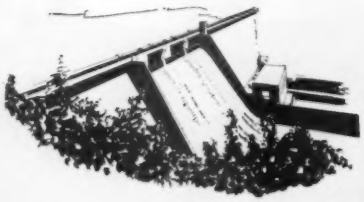
SOUTHERN STATES
HAMPTON, GEORGIA

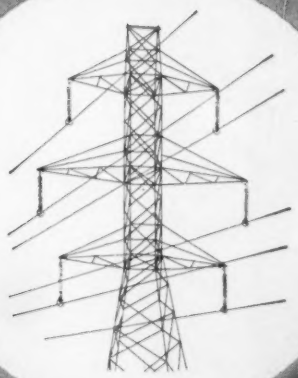
IN CANADA: DOMINION CUTOUT CO., LTD., TORONTO



SHORTEST DISTANCE



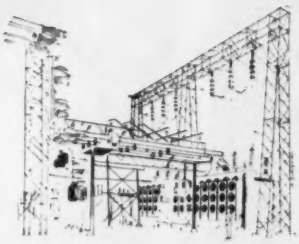


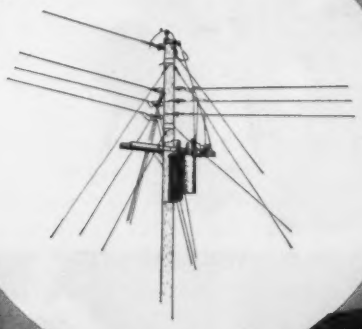


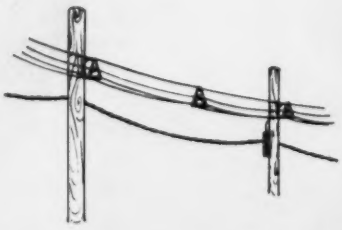
TO QUALITY AND SUPERIOR SERVICE

A SOUTHERN ELECTRICAL LINE

From generation — with transmission lines and distribution lines — to the service centers, SOUTHERN ELECTRICAL furnishes the finest of conductors to serve the electrical utility industry.







OLIN CONDUCTORS

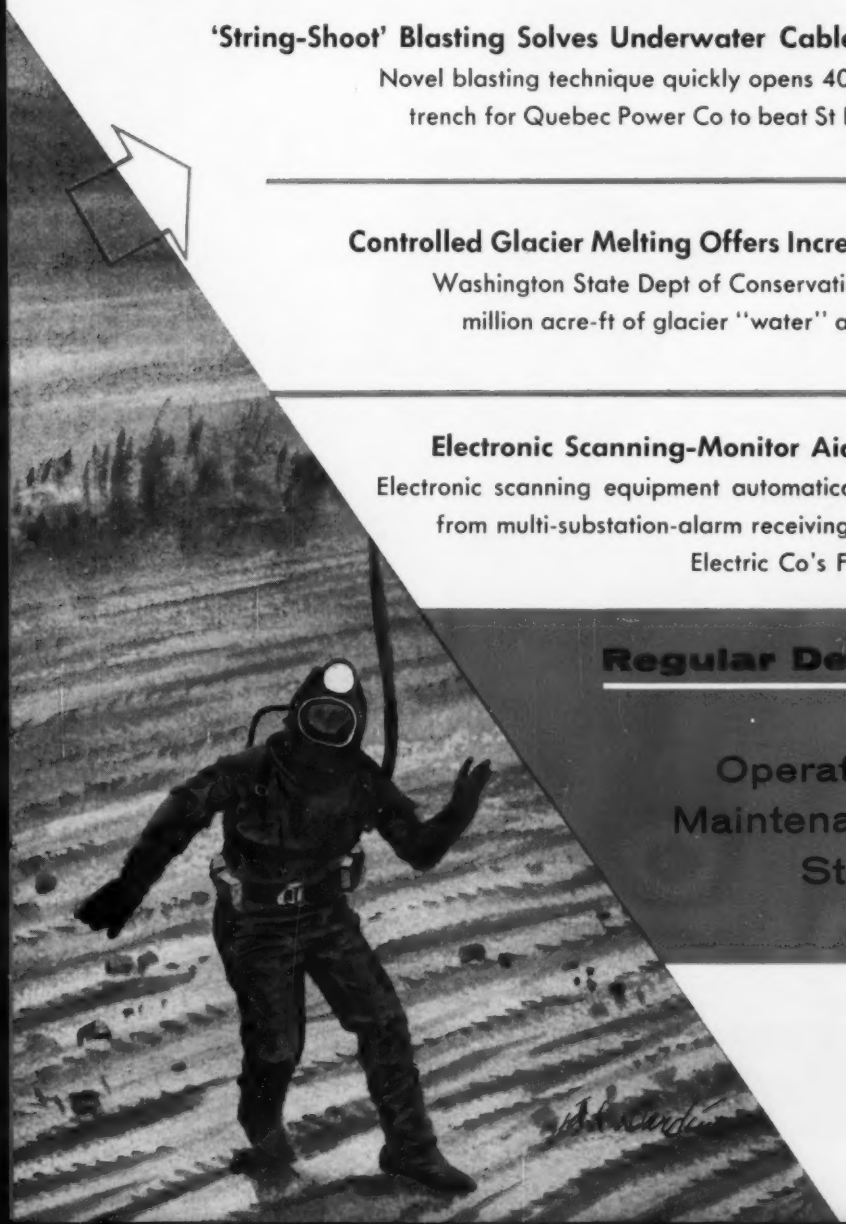
METALS DIVISION Olin P. O. Box 989 • Chattanooga, Tenn.

Electrical World Report

FEBRUARY 1961

ELECTRIC utility methods

CONSTRUCTION • OPERATION • MAINTENANCE



'String-Shoot' Blasting Solves Underwater Cable Trenching Problems p 84
Novel blasting technique quickly opens 400 ft of underwater-cable trench for Quebec Power Co to beat St Lawrence River freeze up.

Controlled Glacier Melting Offers Increased Power Potential p 86
Washington State Dept of Conservation attempts to exploit 50 million acre-ft of glacier "water" as hydro electric resource.

Electronic Scanning-Monitor Aids System Dispatcher p 90
Electronic scanning equipment automatically routes alarm signals from multi-substation-alarm receiving station to Pacific Gas & Electric Co's Fresno system dispatcher.

Regular Departments

Construction p 92
Operation & Testing p 96
Maintenance & Repair p 106
Stores & Shops p 112
Safety p 114

New Equipment p 73
Manufacturers p 116
Literature

here it is! A REAL ONE-HAND TOOL

installs
INSULINK® and LINKIT®
one crimp per end!

You'll like this ONE-HAND TOOL ... from start to finish, you can really work it with only ONE HAND. You can close it with less than a 50 lbs. squeeze; it weighs only 2½ lbs. and is only 12" long. You couldn't ask for an easier service tool ... it's the only *real* ONE-HAND TOOL.

Position the OH25 once ... and only once ... on each side of the INSULINK or uninsulated LINKIT. It has a new die that crimps the entire contact area at one time. You don't have to reposition, you can't overlap crimps, and you never make less than the proper number of crimps.

And, it takes only ONE CRIMP PER END ... a series of easy, ratchet controlled strokes to make a perfect crimp every time. The new dies cause the conductor strands to rub together, removing the oxide film for more stable, low resistance connections.

Insert stripped wire ends into INSULINK; caps grip and hold conductors.

Get up close to your work. Position ONE-HAND TOOL on INSULINK only once per crimp.

A series of easy strokes completes the crimp. Dies produce oxide removing wiping action between conductor strands.

ANOTHER MAJOR DEVELOPMENT IN THE

BURNDY

60-16

CIRCLE 72 ON READER SERVICE CARD

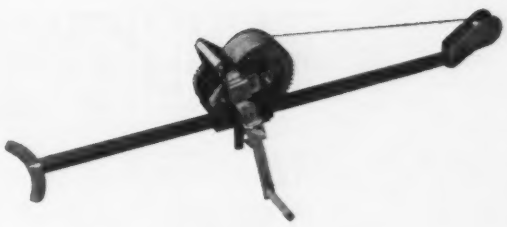
COMPRESSION PROGRAM

NORWALK, CONNECT. BICC—BURNDY Ltd. Prescot, Lancs., England In Continental Europe: Antwerp, Belg... TORONTO, CANADA

To obtain more information on these items, use code numbers indicated for the items when filling in Reader Service Card

Cable Puller . . .

. . . takes only 20 lb of handle pull to exert 1,500 lb of pull on runs up to 200 ft. Flex-a-puller is a new hand-operated, mechanical device for pulling electrical cable through conduit. It can be carried on the job and operated by one man. Said to be a new concept in cable pulling, it uses the outlet box as a support point, making other improvised points of support unnecessary. Because longer individual runs can be made with it than by hand pulling, its use reduces the number of pull boxes needed on small jobs. It is equipped with a two-speed, free-spooling winch and has a pulley head which fits into any standard and special sized outlet boxes. Twisting action is eliminated by the square, straddle pulley support and tubing.
Blackhawk Industrial Div, Butler, Wis. **(1)**

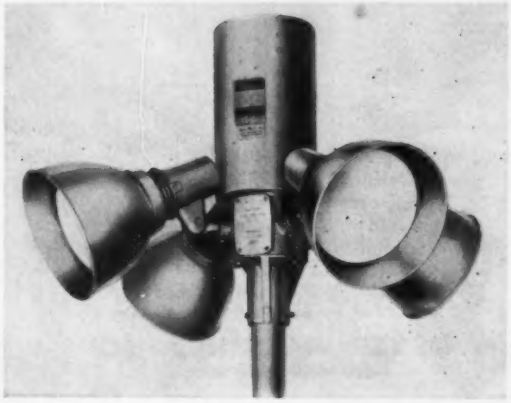


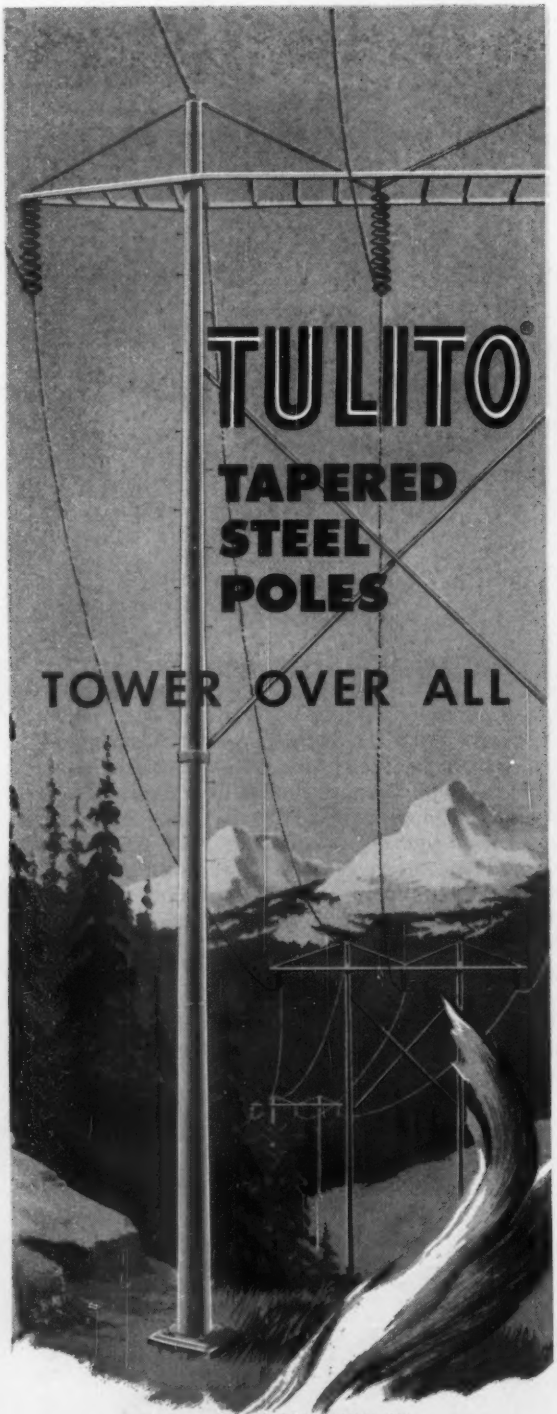
Insulation Resistance Tester . . .

. . . is a portable (5-lb) dc unit for reading insulation resistance of electrical machinery, control, communication equipment, cable, wiring, and electrical parts. The dc testing current is internally converted from alternating current, supplied by the hand-crank generator. The Type M miniature tester is available for work with four rated voltages and five resistance ranges: 1,000 v/2,000 megohm; 500 v/1,000 megohm; 500 v/100 megohm; 250 v/50 megohm; and 100 v/20 megohm. Accuracy is within ±5% of rated resistance values. Response of 0.5 sec permits quick reading of insulation resistance. Testers can be carried by their fold-back metal handles or in a leather case.
Multi-Amp Div, Multi-Amp Electronic Corp, 465 Lehigh Ave, Union, N. J. **(2)**

Mercury Vapor Assembly . . .

. . . fit every wide-area pole-top lighting requirement. Maintenance-free reflector lamps are said to offer more light per watt and constant foot-candle level. Units are designed for a wide range of primary voltages. Four beam patterns are available in either 400 or 1,000 w and in one, two, or four-light assemblies. Ballasts are a low-temperature, weatherproof U.L. listed type. When desired, a remote ballast may be used, or component parts can be used to adapt to existing pole installations. Assemblies are composed of lampholders, ballast, glare tubes or shields and, as desired, are furnished with or without lamps.
Shalda Mfg Co, Inc, 156 W Providencia Ave, Burbank, Calif. **(3)**

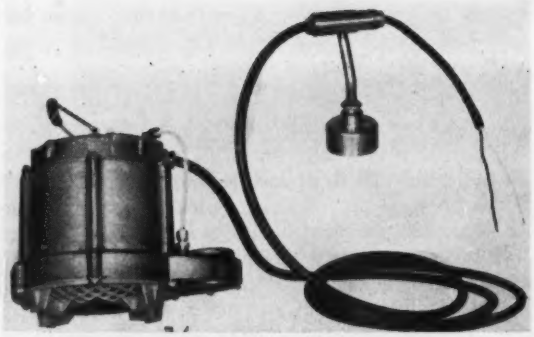




Designed for **PERMANENCE**
Engineered for **DEPENDABILITY**
Equipped with Tulito Safety Clamps to
insure workman **SAFETY** ascending—descending

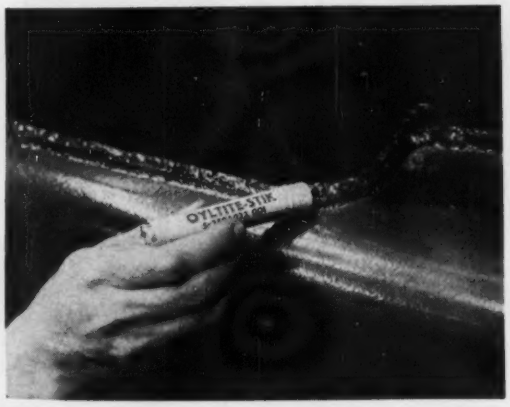
Available with either steel or wood cross arms. For complete information write:

MEYER MACHINE, INC.
RED WING, MINNESOTA



Submersible Pump . . .

. . . for protecting transformers underground. Assembly has heavy cast-bronze housing and ½-hp (115 or 230-v) sealed motor. Pump has capacity of 3,300 gph at 10-ft head. Two-vane pump impeller, and 3½-in. inlet allow vault-grate trash droppings to be removed with the drainage and ground water while the strainer base guards against clogging from larger solids. Air, under bell-housing, actuates pump as fluid level rises. Unit contains water-tight connecting box for integral-molded thermoplastic power cord.
Kenco Pump Division, 1305 Oberlin Avenue, Lorain, Ohio. **(4)**



Transformer Sealant . . .

. . . seals transformer oil leaks through cracks or pinholes in welds or joints. Oyltite-Stik repairs many oil seepage leaks while the transformer is still in service, thereby eliminating costly service interruptions. It stops leaks even while the oil is seeping through cracks or splits and is not affected by temperature changes. It remains plastic, expanding and contracting with the part repaired. The sealant is dark gray and comes in cylindrical form about ½ in. dia. Rubbing Oyltite-Stik over the leak several times forces the material into the leak. It is supplied in cartons containing six Stiks.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa. **(5)**

(More New Equipment on page 76)

ONE-TIME FUSE

(Silver-Plated)

The only AC Rated One-Time, tested and proven on AC. U.L. Approved. Competitively Priced. Order now for *Predictable Performance.*

ask for bulletin O-T 601

THE CHASE-SHAWMUT CO.
Subsidiary of I-T-E CIRCUIT BREAKER CO.
374 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS

CIRCLE 125 ON READER SERVICE CARD

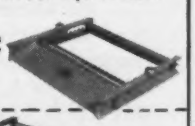
- Easily portable
- No jacks
- Handle any reel diameter
- Heavy steel frame
- Slanted front
- Ball-bearing, adjustable rollers
- Positive roller lock for unloading

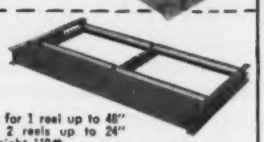
Load cable, wire, rope or anything on reels onto Roll-A-Reel for easy, smooth pay-out or take-up.

All are drilled for optional auxiliary ball-bearing side rollers, $5.00 per set extra.

STYLE A

2,000 lbs. cap. for reels up to 28" wide. Weight 60#.
PRICE $46.50
f.o.b. Cincinnati





STYLE B

4,000 lbs. cap. for 1 reel up to 48" wide; or for 2 reels up to 24" wide each. Weight 110#.
PRICE $84.50
f.o.b. Cincinnati

• Special sizes on request.

ROLL-A-REEL 4628 Reading Road Cincinnati 29, Ohio

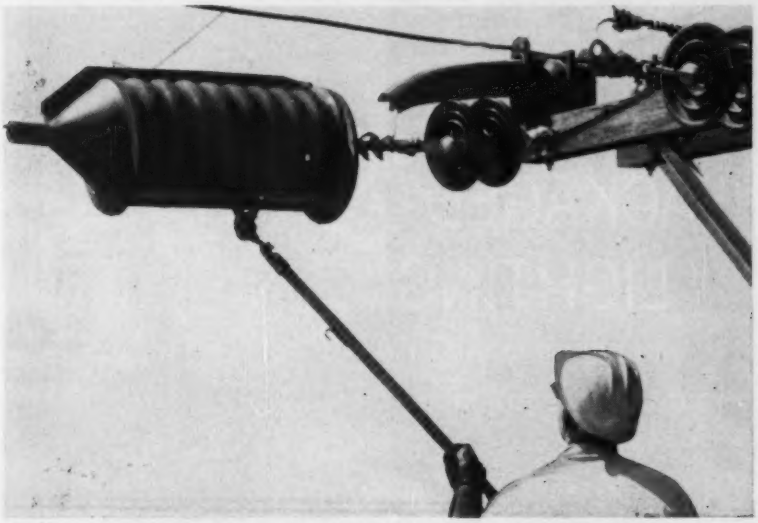
CIRCLE 126 ON READER SERVICE CARD

New! SALISBURY

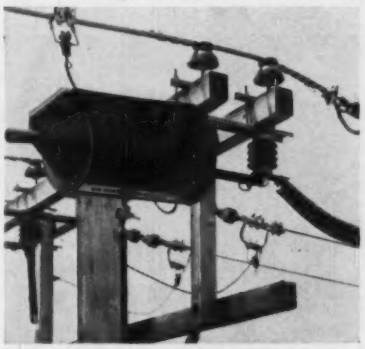
UBANGI DEAD END PROTECTOR

For Time-Saving Hot Stick Application on

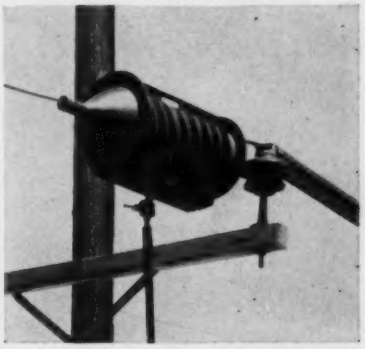
- **Dead End Bells up to 10 inches**
- **Underslung or Vertical Disconnect Switches**
- **Large Size Pin and Post type Insulators**



Applying Ubangi Dead End Protector on 10 inch bells.



Applying on underslung switch.



Applying on large pin insulator.

Salisbury's new Ubangi Dead End Protector is lightweight—only 9-¾ pounds—yet is rugged and highly impact resistant. Used with Salisbury's one-man Ubangi Applicator, it cuts installation time and costs and interlocks with both Ubangi Line Hose and regular Rib-Grip Line Hose. Molded of semi-hard stock, it features an exclusive design with corrugated body and eccentric flanges that grips firmly to resist lateral movement. Write for descriptive literature.

OTHER UBANGI PRODUCTS DESIGNED FOR HOT STICK WORK INCLUDE UBANGI CORONA RESISTANT LINE HOSE, INSULATOR HOODS, CONNECTORS AND BLANKETS.

W. H. SALISBURY & CO.

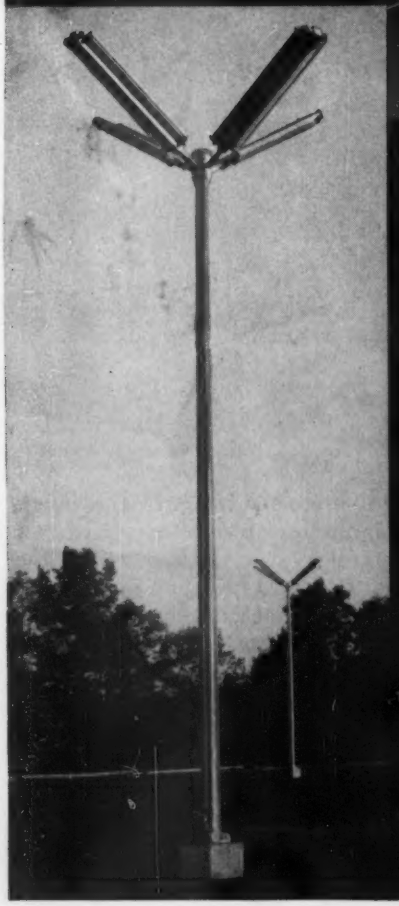
401 N. Morgan Street • Chicago 22, Illinois

CIRCLE 75 ON READER SERVICE CARD

MODERN
IN MATERIAL,
IN STYLE,
IN LIGHTING
EFFECTIVENESS

P&K

"PACKAGED"
LIGHTING
aluminum standard
and LUXaire luminaire



FOR STREET LIGHTING

City of Holyoke, Mass. chose the P&K "packaged" LUXaire unit for their new street lighting installation, consisting of 30 foot mounting height tapered aluminum standards and 6 foot fluorescent 600 watt luminaires. "Best light source in the city" says City of Holyoke Gas & Electric Dept.

FOR AREA LIGHTING

King's Dept. Stores, Inc., Brockton, Mass. parking area gets all the light it needs to invite shoppers to park in safety. Distinctive P&K "Starburst" design minimized cost yet provided maximum illumination.

It's a fact, P&K lighting standards are modern in total concept: made of aluminum to provide light weight with strength ... styled in timeless good taste with a functional design that minimizes inventory of parts and speeds installation ... and most important of all ... P&K provides the complete "package" to assure the maximum of lighting effectiveness. And of course, handling standards and luminaires from one reliable manufacturer makes your job so much easier. For latest P&K catalog information, ask your P&K representative or write

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Toronto, Montreal, Vancouver

Vacuum System . . .

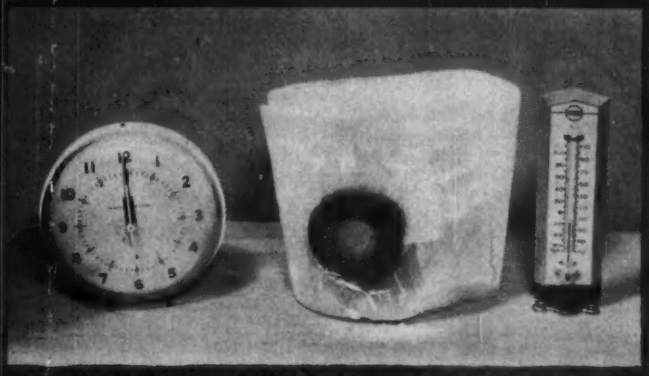
. . . eliminates need for anchor-holes in masonry drilling. The new Truco Tru-Vac Vacuum Pad is applied to a Model A Truco portable diamond drilling machine to anchor it rigidly to the floor for high-speed, heavy-duty drilling. Holes up to 14-in. dia can be made in reinforced concrete, tile, marble, brick, etc. The vacuum pad is a flat, aluminum pad resting in a molded rubber gasket which seals it to the floor when vacuum is applied. Vacuum is developed by means of an electric motor and pump unit which plugs into any standard circuit. The motor quickly develops and maintains vacuum up to some 1,000 actual lb (4,000 lb in the larger model). The Tru-Vac pad can be used with almost any drilling machine. **Masonry Drilling Div, Wheel Trueing Tool Co, 3200 W Davison St, Detroit, Mich. (6)**

Plastic Tape . . .

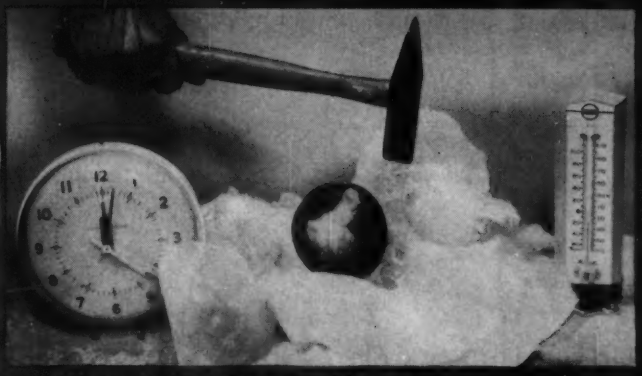
. . . for electrical wire applications from 50F to 180F. The black tape having an over-all thickness of 8.5 mills has excellent tensile strength, 135% elongation, outstanding dielectric strength, and high adhesion. It is available in a variety of widths and lengths from the standard ¼-in. wide, 36-yd long roll. **Permacel, US Highway No. 1, New Brunswick, N. J. (7)**

(More New Equipment, p 78)

WHEN IT'S COLD - THE SPLICE WILL HOLD WITH SLIPKNOT CW VINYL ELECTRICAL TAPE!



A roll of Slipknot CW is frozen solid in a block of ice at 14° F below zero.



Tape is broken out of ice . . . still at 14 below . . .

and in this frigid atmosphere remains completely flexible — strips perfectly from roll — even with ice still imbedded in the core.

At 14° F below zero, this remarkable vinyl tape

- **Strips easily from the roll . . .**
- **Remains completely flexible . . .**
- **Sticks down instantly — molds perfectly — holds permanently!**

Try it in your home freezer — write for a sample roll on your letterhead today!

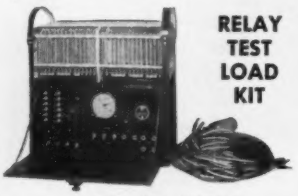
35 seconds later perfectly conforming splice is made. Temperature . . . still 14° below!

TAPES BY
SOLD ONLY THRU RECOGNIZED DISTRIBUTORS
PLYMOUTH RUBBER COMPANY

STATES TESTING EQUIPMENT

FOR TESTING

RELAYS



RELAY TEST LOAD KIT

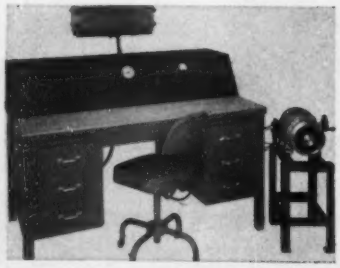
CAT. NO. 33559-R

Compact Kit includes Load, Cycle Counter, Rheostat and Control Switches. Smooth current adjustment from .05 to 58 amperes.

TYPE "WR"

In single and double primary and in 30, 50 and 60 ampere capacities.

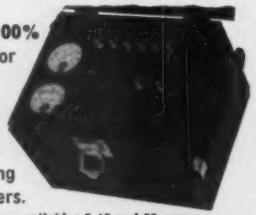
STATES PRESENTS A Wide Range of RELAY TEST TABLES



FORM RFA—Adjustable Current and Potential & Phase Displacement in either 5° steps or continuously.

TYPE ID LOAD

Provides **50% and 100%** Power Factor from **Single Phase Supply** when testing power meters.

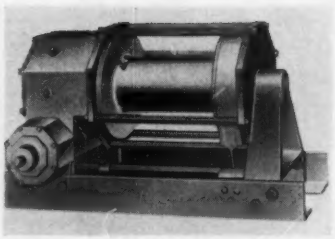


Capacities available: 5-15 and 50 amperes

CATALOG DATA SENT UPON REQUEST

THE STATES COMPANY

3 New Park Avenue • Hartford, Conn.



Power Winch . . .

. . . **eliminates key shearing** through its new transmission torque direct from gear spider to drum. The heavy-duty hoisting and pulling winch has a hoisting capacity of 20,000 lb. It features a stationary shaft and torque is transmitted directly from gear spider to drum by means of a multiple-splined collar in the gear housing, whereas conventional winches transmit drum torque load from shaft to drum by the use of keys. Gear ratio of the unit is 38 to 1 and it is engineered to use standard lubricants.

Koenig Iron Works, Inc, Box 7726, Houston 7, Tex. (8)

Indicating Gage . . .

. . . **measures liquid levels** within containers where moving parts and floats cannot be used. The new Sonometer is a remote indicating gage which is fully transistorized and direct-reading. No bridge balancing is required, nor do changes in cable length affect system operation. Readily gages most homogenous, relatively suspension-free liquids,

1ST CHOICE of UTILITY COMPANIES!

HKP® PORTER COHARDITE INSULATED ELECTRIC WIRE CUTTER

For Fastest Safest • Surest Live Wire Cutting!

• Made with utility men in mind! • Cuts insulated wire soft or medium hard, solid copper wire and medium hard steel wire up to ½"! • Rugged, durable handles, Cohardite insulated • Factory-tested to 20,000 volts! Also available with round edge jaws for harder wire.

The TN STEEL CABLE CUTTER

For Steel Cable & Wire Rope

Shear-action cutter — cuts all soft or hard steel cable and wire rope up to ¾"! No deforming of wire — notched jaws lock cable during cut! Cuts fine or course stranded cable easily and cleanly.

2 CN SPECIAL SHEAR CABLE CUTTER

For Copper and Aluminum Cable

Cuts soft, non-steel cables, insulated or not, up to 1⅜"! O.D. Jaws pass each other for clean cutting! A "must" for every company using Copper or Aluminum Cable. Not recommended for ACSR.

Order from your supply house or write direct for free PORTER CATALOG — Showing many other tools for utility companies.

HKP® H. K. PORTER, Inc.
Somerville 43, Mass.

using proven sonar techniques. Basic read-out is calibrated in feet, inches, or gallons. A second read-out may be made available in 0 to 100 mv dc output, directly in proportion to level. Other, "more sophisticated" read-outs are provided as applications dictate. Under certain instances, liquid density information may be extracted as a by-product.
Acoustica Associates, Inc, Marketing Department, 10400 Aviation Blvd, Los Angeles 45, Calif. (9)

Mercury Luminaires...

. . . for low-level lighting of residential areas or secondary streets are available with built-in constant wattage or high-power-factor reactor ballasts. The Unitized Urbanoval is a new 2500 Series luminaire which uses 100, 175, or 250-w mercury lamps. It features modern, precision-cast aluminum housing with integral slipfitter in models to fit 1¼ or 2-in. pipe-mounting arms. It is available with or without locking-type receptacle for EEI-NEMA standard plug-in photoelectric control. A choice can be made of refractors and lamps.
Revere Electric Mfg Co, 7420 Lehigh Ave, Chicago, Ill. (10)

Dry-Type Chemicals...

. . . are used as replacements for liquid acids. An alkalinity-pH depressant and an acid cleaner are based on sulfamic acid. Both contain over 95% active acid and are quick-acting and readily soluble in water. Ionac Dry Acid Cleaner No. 1332 and Alkalinity-pH Depressant No. 1331 are available in 50 or 100-lb fiber drums.
Ionac Chemical Co, (Div of Pfaudler Permutit Inc,) Birmingham, N. J. (11)

(More New Equipment, p 80)

Crapo GALVANIZED **STEEL STRAND**

Mandrel Test*

Checked and Double-Checked by Laboratory Technicians

Every coil of wire used in the manufacture of *Crapo* Galvanized Steel Strand is tested and approved by trained laboratory technicians. Samples from both ends of each individual coil are subjected to a series of prescribed tests before stranding. Then, the finished strand is re-checked to make certain that it conforms in every respect to established specifications and our own high quality standards.

Thus you know when you specify *Crapo* Galvanized Strand that every precaution has been taken to assure maximum performance in the finished product.

Write for Free Booklet

"The Story Behind Crapo Galvanized Wire and Strand" illustrating and describing manufacturing techniques and testing procedures. Ask for Booklet B-59!

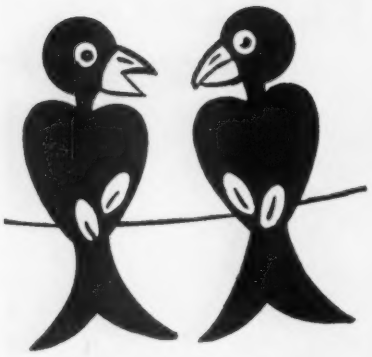
AVAILABLE IN 3 COATING WEIGHTS

FOR GUYS, MESSENGER AND OVERHEAD-GROUND WIRE

Crapo Steel Strand is available in all standard sizes and grades and in Class A, B and C galvanized coatings. Class B coating is twice as heavy as Class A coating; Class C coating is three times as heavy.

*Determines ductility of wire and adherent quality of galvanizing.

INDIANA STEEL & WIRE CO., INC.
Muncie, Indiana



"It's sure a good feeling to know that this wire is attached to Haley cross arms!"

Haley's

CEDAR POLES

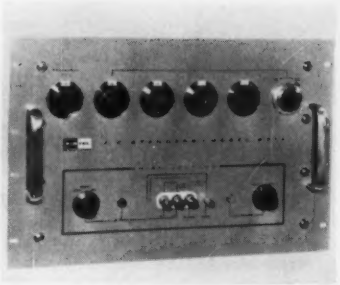
and

FIR CROSS ARMS

Light in weight and clean. PENTAchlorophenol treated in our modern plant for protection against decay, moisture and insect damage.

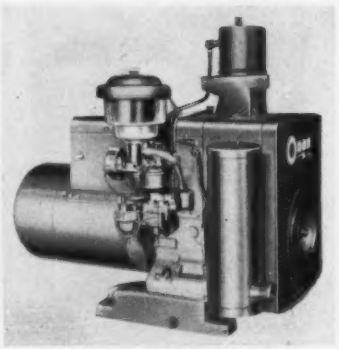
TWO strategically located yards:
MINNEAPOLIS, MINNESOTA
FINDLAY, OHIO

R. G. HALEY & CO.
SPITZER BLDG.
TOLEDO 4, OHIO



Ac Voltage Source . . .

. . . supplies from 1 to 501 v; 60, 400 and 1,000 cps output frequencies. It has voltage accuracy to 0.1%; short-term stability of 0.01%; frequency accuracy of 1.0%; less than 0.3% harmonic distortion; and power output 5 amp to 5 v, 25 w above 5 v. Model 601A ac voltage standard provides fast, direct calibration of high-accuracy ac measuring instruments.
Kin Tel Div of Cohu Electronics, Inc, San Diego, Calif. (12)



Standby Plant . . .

. . . is 2,500-w, air cooled. Outputs available are: Model 205 AJ-IR30, which provides 2,500 w of 120-v, 60-cycle, single-phase, 2-wire ac, and Model 205AJ-3R30 which provides 2,500 w of 120/240, 60-cycle, single-phase, 3-wire ac. Both are gasoline driven and available for operation on natural gas of LP gas. A single-cylinder, 4-cycle, air-cooled model AJ engine is connected directly to a 2,500-w all-climate generator.
Onan Div of Studebaker-Packard Corp, 2515 University Ave, SE, Minneapolis 14, Minn. (13)

LOOK what we've had up our sleeve!

Now IT'S OUT

Another **SHAWMUT** *First . . . All NEW* **ONE-TIME FUSE** *(Silver-Plated)*

Meets Federal Specs For One-Time & Time Delay. Exceeds all industry standards for One-Times. U.L. Approved Buy now for "predictable performance."

THE CHASE-SHAWMUT CO.
Subsidiary of I-T-E CIRCUIT BREAKER CO.
374 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS
CIRCLE 128 ON READER SERVICE CARD

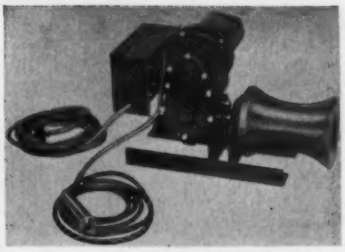
NOW...
TROUBLE-SHOOT TROUBLE SPOTS *FAST*
Save valuable Kw-hrs.

DICE MICROHM METER
Favorite of leading utilities for all low-resistance measurements on material tests, circuit breaker contacts, bus bar connections, cable joints.
MEASURES DOWN TO *ONE* MICROHM!
J.W. DICE CO. ENGLEWOOD, N.J.
CIRCLE 129 ON READER SERVICE CARD

Whether a **Winch** *Line Hook or a complete Line Body check your requirements with*

UTILITY TOOL & BODY CO. UT&BCo
CLINTONVILLE, WISCONSIN

CIRCLE 80 ON READER SERVICE CARD
CIRCLE 130 ON READER SERVICE CARD



Capstan Winch-Hoist

. . . is a portable unit which handles manila rope for safe use near power lines. The My-te Capstan Winch-Hoist battery model works off any 6 or 12-v car or truck battery; the 110-v ac model operates from a portable generator or other power source. Pulling capacity is 500 lb with single line, 1,000 lb with double line. Used with block and tackle, it will lift a 2,000-lb transformer. Capstan speed is 32 rpm, gear ratio is 175 to 1. Hoist has stress-proof shafts, completely sealed gear housings, and 10-ft remote control cable with forward and reverse action. Worm and worm gear holds the load in any position. Dimensions are 14x12x19 in. Weight is 60 lb.
City Engineering Co, Inc, 3547 Massachusetts Ave, Indianapolis 18, Ind. (14)

Wedge Clamp . . .

. . . is a snap-in type for service entrance connections. Clamps for conductor ranges of No. 6 to No. 2 ACSR and No. 4 to 1/0 ACSR are available. Just one squeeze securely snaps the stainless steel ball to the wedge after the ball has been looped through a wireholder. The conductor tension keeps the connection from uncoupling.
A. B. Chance Co, Advertising Department, Centralia, Mo. (15)

FOUR PRINCIPLES FOR TRANSFORMER PAINTING

1. **Color.** There is a direct relationship between color and operating temperature. Subox paints are made in modern colors to meet *present-day peak load requirements.* They are available in standard grays, and also in decorator shades for color-styling in residential neighborhoods.
2. **Film Thickness.** When repeated coats of paint build up on a transformer they tend to act as a blanket and hold the heat in. With Subox paints, *fewer coats are needed* and internal heat is more efficiently dissipated.
3. **Long Life.** The paint on a transformer is subject to wide temperature changes. *All Subox paints contain suboxide of lead.* This unique pigment remains chemically active even after drying; builds a tough, fibrous film that maintains flexibility and does not crack, chip, peel or blister even under the most punishing conditions.
4. **Film Structure.** Aluminum-containing paints are often desired because they reflect sunlight; however, in conventional paints of this type the aluminum flakes overlap and leaf together to form an insulating barrier. In our Subalox paints, the polished aluminum flakes are non-leafing and do not overlap. Therefore, they promote both reflection and better radiation.

Leading electric utility companies use Subox paints for transformers. Write for color card and literature.

SUBOX PAINTS

Subox Inc.
Trade Mark

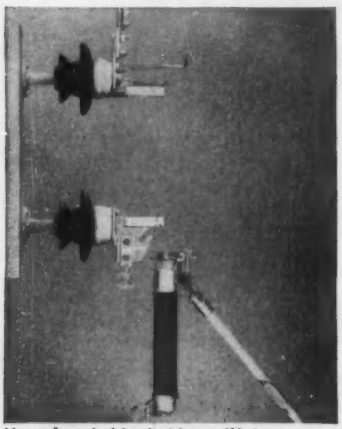
Established 1924
3 Fairmount Plant, Hackensack, N. J.
Subox Company of Canada, Weston, Ontario

CIRCLE 81 ON READER SERVICE CARD

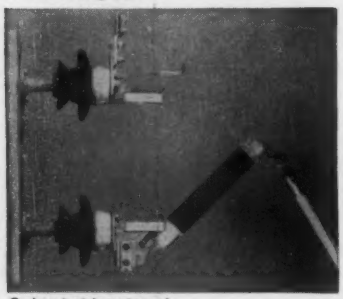
LOW-COST SWITCHING

HOW THE SM-4 SWITCHES

Photo at right shows the fuse being opened with Loadbuster. Photos below show closing sequence with conventional handling tool.

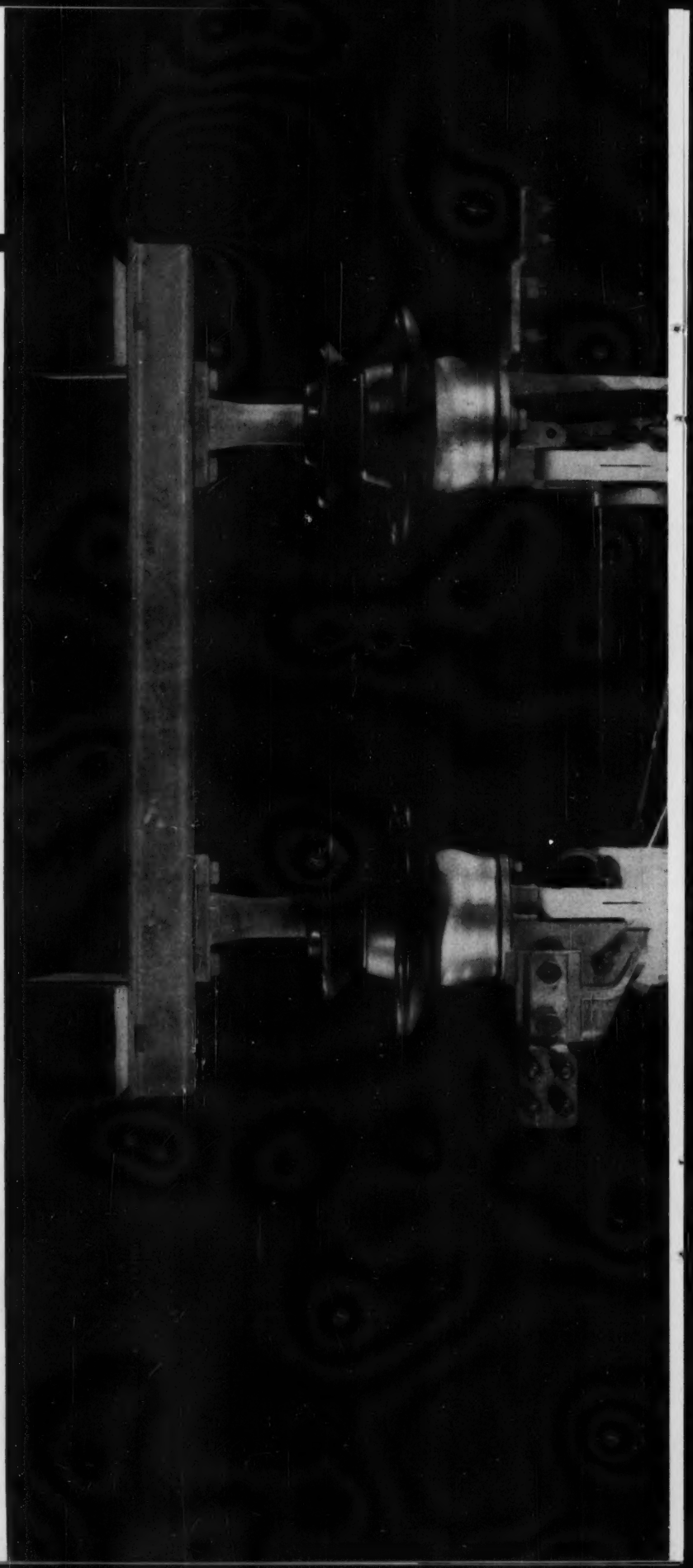


Hang fuse holder in hinge. (Note disconnect gap) . . .



Swing holder closed . . .

No need to worry about closing on a fault —the SM-4, a boric acid fuse, interrupts effortlessly.



Now even power fuses operate with S&C's Loadbuster® — no need to add a disconnect

That's right . . . no disconnect required! If it's S&C's outdoor SM-4 Power Fuse, you switch with the fuse itself—plus Loadbuster.

On transformer primaries there's no separate investment in disconnects for energizing, or for de-energizing and isolating. For line sectionalizing the same holds true—and then some! With Loadbuster it's possible to drop the line, split the load, even dump the load—up to 14.4 kv.

Here's how it works. The SM-4 Power Fuse is equipped with an attachment hook to accommodate Loadbuster. Just hook Loadbuster onto this hook and into the pull ring, pull fuse open and the circuit is interrupted. Result: full load switching at full voltage with no arcing, no contact burning. In one device you get full switching and isolation as well as fault protection.

The key to the Loadbuster system of universal, low cost load switching? Portability! . . . bringing the interrupting device to the power fuse, disconnect, or cutout only when it's needed. In this way the cost of Loadbuster is spread over all the fuses, disconnects, and cutouts on the distribution system.

For more information contact S&C Electric Company, 4421 Ravenswood Avenue, Chicago 40, Ill. We will be glad to give you a demonstration of how Loadbuster works.

S&C ELECTRIC COMPANY

S&C

CIRCLE 83 ON READER SERVICE CARD

ELECTRIC
UTILITY
METHODS

EU

FEATURE SECTION

'String-Shoot' Solves Underwater Cable Trenching Problems

HUGH G. JARMAN, Feature writer, Montreal, Canada

SINGLE MAIN BLAST lifts column of water 400 ft into the air—while no muck or rock was thrown up in the blast area; a 370-ft trench was achieved

A 400-ft-long underwater cable trench in the St. Lawrence River was recently excavated quickly and cheaply by Quebec Power Co using a new "string-shoot" blasting technique. Furthermore, the underwater trenching was accomplished despite unfavorable bottom conditions, limited daylight, strong river currents, and the threat of winter freeze-up.

Recently, Quebec Power laid a new 12-kv cable on the bottom of the St. Lawrence River between Ile D'Orleans and L'Ange Gardien on the north shore. To protect the cable against winter ice packs, Quebec Power had to bury a 400-ft length of the cable to minimum depths varying from 18 to 24 in. beneath the riverbed. The riverbed along the proposed cable path, consists of a 10 to 20-in. layer of sand, silt and very soft clay, overlaying harder bands of clay and gravel. QPC began excavation of the trench with a clamshell, but these initial attempts were unsuccessful because a large number of boulders were encountered. Then the International Underwater Contractors Ltd, of Montreal, a company which specializes in underwater explosive work, was engaged to blast the cable trench.

The initial blasting plan involved a "spaced-charge" technique which had proven feasible at other locations having similar loose unconsolidated bottom material. With this method explosives are confined to holes of varying depth, and intervals—the depth of the holes and their spacing intervals are a function of the water depth. For the Ile D'Orleans trench "spaced-charge" blasting required holes 3 ft deep, spaced every 2 ft for a water depth under 5 ft and for the deeper water, 5 to 18 ft, the depth of the holes had to be increased while the spacing between the holes had to be decreased. A special, 5-ft-long water-jet lance was used by divers to pierce to the required depth in the river bed.

As the work commenced, it was found that although the lance could penetrate to the required depth, the coarsely packed gravel and brittle clay offered considerable resistance, all of which made the piercing operation very time-consuming.

Because it was necessary to complete the trench before the ice began to form, and because diving in the strong current of the channel had to be restricted to the few hours of daylight then available each day, a faster method had to be employed to prepare for placement of the explosives. The solution to this problem was found in the use of a novel blasting technique called "string-shooting," by which the desired trench was satisfactorily excavated by detonating a column of explosives laid directly on the riverbed, along the line of the trench.

Test Blast Provides Information

To insure success of the "string-shooting" technique and to iron-out the details involved in stringing out the column of explosives for the main-trench blasting, QPCo undertook a trial blast. A 30-ft length of the proposed trench was selected for the test blast, and the test column or string of explosives prepared on the deck of the barge.

The 30-ft column consisted of groups of three 2½ in.x16 in. Cartridges of Submagel 95%, with each group providing an explosives load of about 7 lb per ft. The three-unit groups were tied lengthwise, both with electrical friction tape and copper wire, continuously along a length of manila rope, along which ran double lines of Primacord fuse. The complete column was arranged so that the rope carried all of the tension incurred in handling, without allowing excessive slack in the Primacord fuse lines. The explosive string was then transferred from the barge to the diver's dory, care being taken to prevent kinks from forming in the fuse lines. One end of the charge was weighted with 60 lb of steel rails, and lowered to the river-

bed by the divers, while the remainder of the charge containing an extended length of taped rope and double Primacord fuse was temporarily kept in the boat. After being weighted with additional weights to prevent its displacement by the current, the explosive string except for the extended length of rope supported Primacord was lowered by the divers to the correct position on the bottom. Buoys were placed to mark the line of the trench.

The explosive string was then primed by means of a DF Primer threaded over the ends of the Primacord fuse lines. A zero delay "Short-Period" cap was inserted into the DF Primer and the entire assembly taped securely in place with friction tape. The legwires from the short-period-cap were connected to the main lead wires extending to a 110-v power source on shore.

The test blast was fired when the tide brought water depth over the explosive column to between 9 and 11 ft. The shot excavated a trench 30 ft long and 2 to 3 ft in depth. In the soft upper layer of silt the width of the trench was about 12 ft, while in the packed gravel and clay beneath, a flat-bottomed, 2½-ft trench with cleanly sheared walls was achieved. Although the trial section of the achieved trench was satisfactory, in order to provide for a margin of error it was decided that for the remainder, it would be desirable to increase the explosive load slightly for the specific depth of water tested and further, to adjust it as necessary for any increase in water depth. The heavier charges would also ensure that any boulders would be shattered effectively and that the fragments would be dispensed completely.

Single Blast Excavates 370-ft Underwater Trench

The 370-ft length of trench still to be excavated was first divided into sections, based upon the water depth expected above at the moment of firing. The charge was then made up to suit the conditions for each section, with additional charges added along the explosive column to demolish boulders.

As in the trial blast, the charges consisted of groups of explosive cartridges tied together continuously on a length of hemp rope, along which were strung double lines of Primacord fuse. In preparing for the test blast considerable difficulty had been met in lowering the charge into position—the column lacked the proper rigidity. Accordingly, for the main blast, the tape and wire bindings were reinforced with textile strapping, tightly applied by a hand strapping machine. Further, the strings were made up in shorter lengths of 12-13 ft, to make them easier to handle in the swift current. The additional strapping of the shorter lengths held each explosive string sufficiently rigid to allow the divers to maneuver into position on the riverbed.

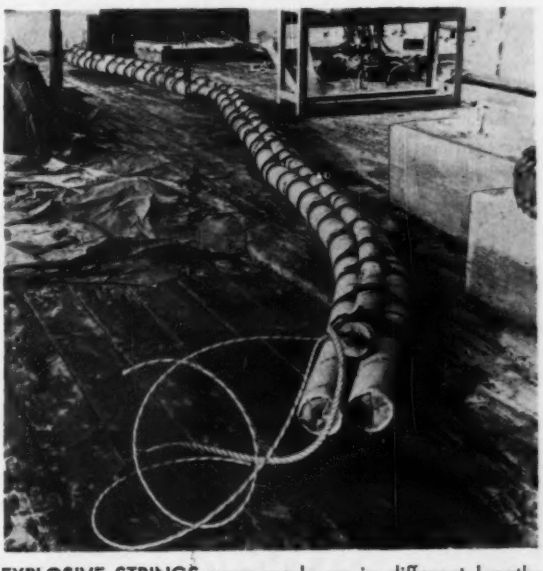
The explosive load varied from 7 lb per ft (for use in 11 ft of water) to 17.7 lb per ft (for use in 20 ft of water). Forcite 60% in 4x16-in. cartridges, and Submagel 95% in 2½x16-in. cartridges, were used for the charges.

The explosive strings were primed throughout their entire length with Primacord fuse lines. Adequate free ends of the Primacord line, together with a similar free length of the rope, were purposely left at the ends of each string of explosive to allow for connecting to the next string. Support connections between the strings were achieved by tying together the extended free ends of rope from each section. The explosive connections between strings were accomplished by securely tying the Primacord lines of one string to similar lengths extending from the next section or string. The DF primers were threaded over the Primacord lines and placed at the connecting joint of each two strings—just prior to lowering that section down to the riverbed. As each joint was completed it was weighted to and lowered to divers for positioning on the riverbed. The same procedure was followed along the entire length of proposed trench.

Single Main Blast Is Effective

As with the earlier trial blast, a zero delay short-period-cap was inserted into a DF primer, which in turn was threaded over the free ends of the Primacord lines brought shoreward. The detonator assembly was then secured with friction tape and the legwires of the short-period-cap were connected to the main lead wires extending from a 110-v power source on shore. The blast was fired at high tide, in order to provide sufficient confinement to the explosives charges. At the instant of blast, a column of water rose approximately 400 ft into the air. It was noted that no muck or rock was thrown up in the blast area. There was little noise or ground shock from the blast.

Subsequent inspection by divers showed that the shot was successful in excavating the desired trench. In the harder portions of the river bottom, a trench of a usable depth of 4 ft was clearly evident, while in the less stable areas, the soft materials were dislodged sufficiently to allow laying the power cable to the required depth beneath the river bed.



EXPLOSIVE STRINGS were made up in different lengths and varying blast-charge as required to suit the varying depth of water and random boulders encountered

CIRCLE 85 ON READER SERVICE CARD

Glacier Melting Promises Increased Hydro Power

TRUMAN P. PRICE, Supervisor, Division of Power Resources, Dept of Conservation, State of Washington

A research program seeking eventually to expoit glaciers as a hydroelectric resource by controlling their melting has been launched by the Washington State Department of Conservation.

Specific objectives of the research program are to:

- Measure mass-balance of the glacier (how much snow accumulates, how much melts, and how much is left each year).
- Relate the rate of evaporation, melt and runoff to meteorological factors.
- Investigate the effect of artificial modification of reflectivity on rate of evaporation, melt, runoff and mass-balance of the glacier under differing meteorological conditions.
- Investigate effectiveness of different materials for modifying the albedo in order to increase the melt.

The possibilities are of keen interest to the State of Washington, for its glaciers hold about 50 million acre-ft of water—comparable to the maximum storage potential of the Columbia River and its tributaries.

A portion of this great volume of ice-stored water can be controlled by techniques, described in Russian scientific magazines, that consist of scattering carbon particles over the glaciers. The carbon particles absorb radiant energy from the sun and melt the glaciers at an accelerated rate.

However, the Russians seek primarily to melt river-ice in an order to permit earlier navigation and their articles do not reveal sufficient data to predict results in this country. Further research is necessary to determine over-all feasibility of glacier melting for power generation purposes.

An observation station has been set up for this purpose in the Northern Cascade Mountains at an elevation of more than 6,000 ft. Glaciological, weather and run-off measurements are to be taken daily, and some hourly, until mid-September. This data will be studied by the Department's Division of Power Resources as the basis of a year-end report to determine the course of future studies.

This summer's $5,000 program began in early June when wooden "ablation" stakes 7-ft long were pressed into the snowpack at eight points on a 190-acre glacier at the head of Haystack Creek, ten miles north of Marblemount. The creek drains into the Cascade River, which Seattle City Light Co eventually plans to develop in conjunction with its Skagit River Development.

The research party's first task will be to measure, on the ablation stakes, the drop in level of the snowpack from its peak. It then will measure the total depth of the snowpack and install a variety of instruments: gage recorders to measure water flow escaping from the glacier; hydro-thermographs to measure temperature and humidity; anamometers to indicate wind direction and velocity; and radiometers to measure the amount of heat received and absorbed by the snowpack.

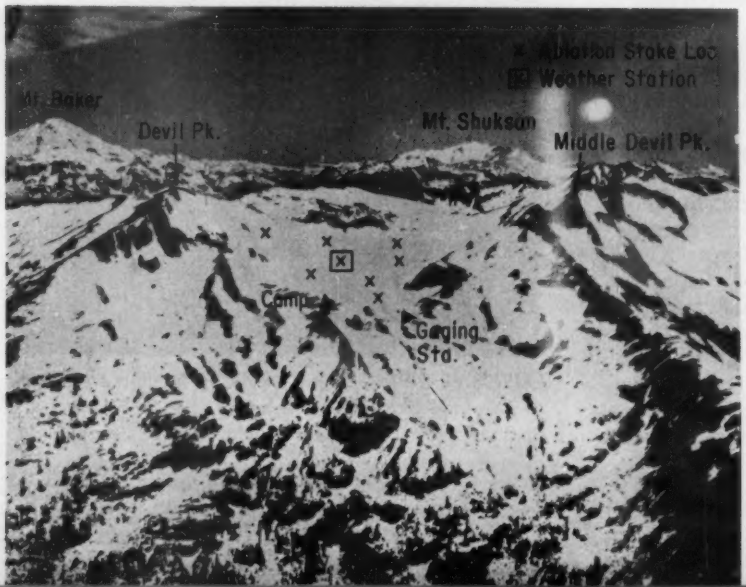
It will also dust 100-ft squares with heat absorbing coal dust as well as native dirts and loams, to determine how much faster the snow will melt when so treated. Various concentrations of the materials will be used from 200-600 lb/acre, with particles of varying sizes, in an effort to determine conditions for optimum glacier melting.

The studies will be directed not only at methods of increasing the rate of melt but also at methods of reducing it, as desired. Techniques will be sought to dissipate the sun's heat into evaporation, rather than water, and thus retain the snow's content for periods of the year when greater runoff is desired.

Glacial melting may eventually be combined with cloud seeding in a double-pronged program of weather modification for power generation. Induced glacier melting alone would probably be conducted only during periods of drought to supplement cyclic water shortage. If cloud seeding is conducted over the glaciers, however, melting operations probably could be conducted on an annual basis. This is because cloud seeding generally increases

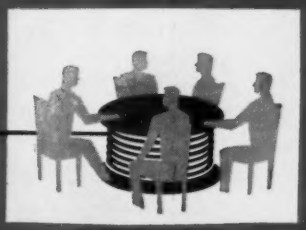
(Continued on page 88)

At elevation of over 6,000 ft, Fred Hahn, hydrologist, and Stuart Shumway, meterologist, will take periodic glaciological, weather, and run-off readings



DU PONT

WIRE AND CABLE ROUND TABLE



You have asked . . .

Q. Your natural-color polyethylene for high-voltage insulation, ALATHON 3B, NC10, has been around for several years now. Have you introduced a better resin?

A. No . . . nobody (including us) has been able to match the resistance of ALATHON 3B, NC10, to combined corona and mechanical stretching (bending) under a variety of conditions. The search for a successor may be academic since we have never had a failure in any of our 15KV cables insulated with the 3B resin. Nevertheless, eternally optimistic about maintaining a lead, we have lots of new compounds under test. If one looks better, we'll be in touch with you.

Q. If ALATHON 3B is so good, tell me how I can be sure of getting its outstanding properties without naming brands?

A. Rely as you ordinarily do, on the judgment of responsible cable manufacturers. There is no simple way yet, outside of our published electro-mechanical stress-crack test, or some equivalent way (not all of which are reproducible) of separating resins of superior electrical life from others of identical melt index and density. Nevertheless, for the present, it will narrow the field somewhat to specify a melt index of 0.2 to 0.4 and density in the general range of 0.92.

Du Pont does not manufacture wire and cable, but supplies thermoplastic resins to the wire and cable industry.

POLYCHEMICALS DEPARTMENT

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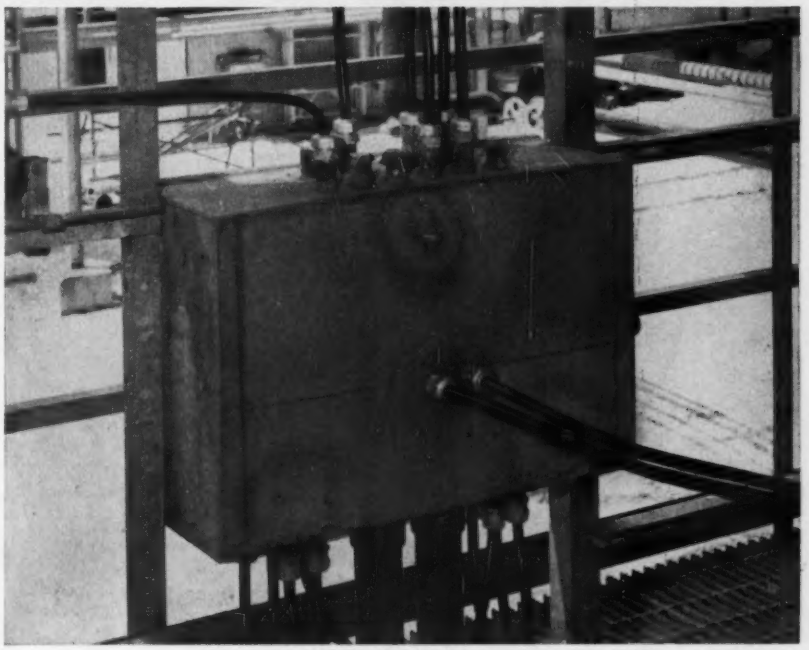


Seven-conductor 600-volt control cable with jacket of ALATHON over the aluminum sheath offers necessary corrosion protection for chemical plant hook-up.

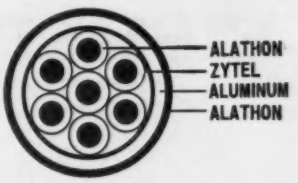
General Cable uses ALATHON® and ZYTEL® for unique control cable construction

The problem of acute corrosion attack on metal conduits has been licked at a Texas chemical processing plant. A unique control cable construction, utilizing a 0.032" jacket of Du Pont ALATHON 4, BK-30, polyethylene resin over the aluminum sheath, has solved the problem. The cable is manufactured by General Cable Corp. of New York.

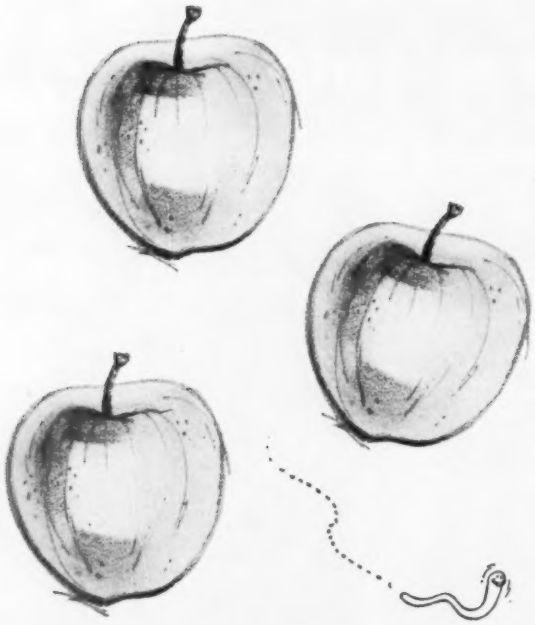
The jacket of ALATHON completely protects the aluminum sheath from the corrosive elements in the air. In addition, it also provides additional electrical and mechanical protection to the cable, and allows quick and neat installation.

The 0.020" primary insulation over the seven conductors in this 600-volt cable is also ALATHON 4, BK-30. This black, weather-resistant type of insulation was used to protect the cable at outside terminations in the open plant structure. Over the primary, a thin 0.004" secondary insulation of ZYTEL 37X nylon resin is used for mechanical protection at termination points. The skin of ZYTEL, which is also weather-resistant, completely protects the cable from rough handling and the abrasion found in crowded junction boxes.

Find out how insulation and jacketing of the Du Pont plastics may give you installation savings. Consult your wire and cable manufacturer. or write: the Du Pont Company, Dept. EW-2, Room 2507A, Nemours Bldg., Wilmington 98, Del. In Canada: Du Pont of Canada Ltd., P.O. Box 660, Montreal, Quebec.



ALATHON® POLYETHYLENE RESINS | **RULAN®** FLAME-RETARDANT PLASTICS | **ZYTEL®** NYLON RESINS



you're right:
most photocontrols do look alike

If most of today's street light controls all look like first cousins — outside, inside and sometimes even in their guarantees — how can you pick out the good ones? You could try putting them all in service, but it would be the most expensive test you ever ran. Another way is to look at *what* components are used, *how* they're used in the circuit, and what the *field experience* of other utilities has been with the control.

Asking enough questions and getting realistic answers *before* you buy 10 or 20 thousand photocontrols pays off handsomely in street lights burning when they should — and in your getting to sleep at night. Fisher-Pierce Division, Sigma Instruments, Inc., 82 Pearl Street, South Braintree 85, Mass.

FP
FISHER PIERCE
Electrical and Electronic Equipment
for Industry, Utilities and the Home

(Continued from page 86)

glaciers at a greater rate than normal weather melts them. Melting operations could be intensified during periods of drought to take advantage of the cyclic storage potential of glaciers.

Seeding operations conducted over the Pend Oreille basin by the Water Resources Development Corp between 1954 and 1958 have increased stream flow an estimated 10.6% in the mountainous sections. Based upon a 10% increase of flow, the seeding has meant an increase of 530 million kwhr annually under critical flow conditions and 469 million kwhr under median flow conditions; in dollars the benefits were $1,240,000 and $1,086,000 respectively. The benefit-to-cost ratio was nine, based on the $139,470 cost of the program in 1958.

An even higher cost-to-benefit ratio was achieved in a cloud seeding operation over the watersheds of the Lewis and White Salmon Rivers farther south in the Cascades, for Pacific Power & Light Co.

Cloud seeding benefits are realized on a rain-fed stream primarily during the rainy season from October to April but the benefits are delayed on snow-fed streams until summer when the snow melts. An increase in the snowpack tends to extend the heavy runoff season since melting is primarily a function of atmospheric conditions and not snow depth. Extension of the heavy runoff could lessen the need for drawing on storage, now needed to firm up flows about eight months of the year.

Annual storage requirements presently are greater for snow-fed streams than for rain-fed steams in the region because the Pacific Northwest experiences peak loads in the winter. During this period, snow-fed streams require storage drawdown while rain-fed streams are at peak flow.

Induced glacier melting offers its greatest benefit during periods of drought when melting seasons are extended. Benefit-to-cost ratios should be very high since critical water periods occur infrequently.

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The product in this advertisement manufactured under one or more of the following: U.S. Patent No. 2,691,865; and 2,761,273; other patents pending.

Electronic Scanning-Monitor Aids System Dispatcher

An electronic scanning-monitor system requires a minimum of circuits to automatically transfer multiple alarm data from a remote multi-alarm receiving station to the Fresno division control center. The prompt alarms, to indicate faults occurring in Pacific Gas & Electric Co's transmission distribution system, help the system dispatcher to minimize outage time.

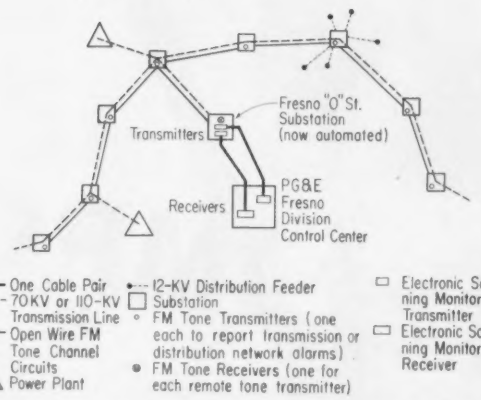
Each substation of PG&E's Fresno division has two alarm systems: an "A" alarm system for the 70-kv or 110-kv transmission system; and a "B" alarm system for the 12-kv distribution feeders—each alarm originating on the substation premise. The "A" alarm system is equipped for 24 alarms and the "B," for 30 alarms. Each system is expandable to 36 alarms if required.

Alarms originating at any of the individual substations, are transmitted by Lynch Communication Systems' tone channel equipment to the "O" Street substation in Fresno, which has the necessary facilities to terminate open wire lines which are subject to extremely high potentials. Originally all alarms received at "O" station were relayed by phone to the Fresno dispatcher. "O" station was in effect "automated" by the new Lynch equipment which reports the alarms directly to the dispatcher and/or service operator.

Information from the many substations coming into the "O" substation channels is fed into the two electronic scanning monitoring systems, each of which operate over a single cable pair. At the Fresno control center, the "A" alarm system terminates in the dispatcher's control room. "A" alarms may be tripped by any one of these faults:

- Tripping of oil-filled circuit breaker
- High or low ac voltage—often caused by sticking regulator
- Loss of dc voltage—used for remote control power source

PG&ECo's Fresno division dispatcher is alerted to transmission system faults by display console (arrow)


Fresno "O" St. Substation (now automated)
Transmitters
Receivers
PG&E Fresno Division Control Center
One Cable Pair
70 KV or 110-KV Transmission Line
Open Wire FM Tone Channel Circuits
Power Plant
12-KV Distribution Feeder
Substation
FM Tone Transmitters (one each to report transmission or distribution network alarms)
FM Tone Receivers (one for each remote tone transmitter)
Electronic Scanning Monitor Transmitter
Electronic Scanning Monitor Receiver

Multi-alarm data from numerous remote substations are received and scanned by electronic monitor system at PG&E Fresno 'O' St Station and then automatically transmitted to system dispatcher at division control center

- Battery charging unit failure
- Transformer cooling water failure
- Low oil alarm (oil-filled transformer)
- Low nitrogen gas pressure (inert gas used in oil transformer).

"B" alarms, which terminate in the dispatcher's control room, relate only to 12-kv distribution feeders—when a breaker opens on a 12-kv feeder, the "B" alarm is sent directly to the service operator.

The monitoring systems transmit continuously by means of coded pulses using a form of time-division multoplexing with each of the individual alarms assigned a portion of time in the total pulse train. The length of the individual alarm pulse indicates whether the alarm is "on" or "normal." Multiple synchronization and logic checking circuits are used to verify correct information transfer from transmitter to receiver.

While the pulse train may be transmitted by tone channel or voice carrier channel for long-haul requirement, in this installation the output signal of 10 v is applied across 600 ohms, directly onto a cable pair. The transmission distance is approximately 2 miles.

Speed of operation here, or when using a voice carrier channel, is such that the entire pulse train, including data for up to 36 alarms, is received every 32 to 44 millisec, depending on the number of "on" or "normal" alarm conditions. If tone channels were used for data transmittal, the pulse train is correspondingly longer because of the limited frequency response of the tone channels.

When the alarms are received at either control center, a trouble shooter can be dispatched by radio to the substation to see that corrective measures are taken.

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Automatic dead ends that are *automatic*. Fargo dead ends work right every time, and are designed for fast, easy and sure installations . . . a wide choice of flexible or solid bails and strap types to fit every job, *all* with Fargo's gripping units, are available.

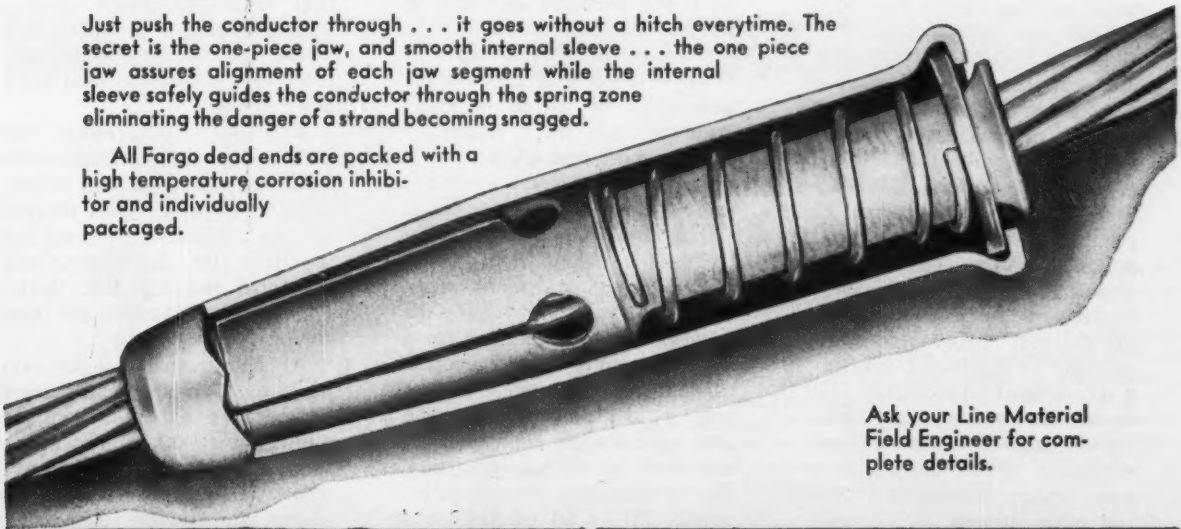
new types...

There are Fargo Dead Ends for copper or aluminum.

NO SNAGGING WITH FARGO

Just push the conductor through . . . it goes without a hitch everytime. The secret is the one-piece jaw, and smooth internal sleeve . . . the one piece jaw assures alignment of each jaw segment while the internal sleeve safely guides the conductor through the spring zone eliminating the danger of a strand becoming snagged.

All Fargo dead ends are packed with a high temperature corrosion inhibitor and individually packaged.



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Helicopter stands by as Aerial Control, Inc, engineer makes tellurometer readings—theodilite is used at the line-end.

Modern Techniques Speed HV Line Survey

D. A. HEAPE, Surveyor Engineer, Southern California Edison Co,
H. VICTOR JACHEL, Electronic Analyst, Southern California Edison Co,
ALBERT V. COCKING, President, Aerial Control, Inc, Los Angeles, Calif.

Surveying an extremely rugged mountain area route for new high voltage transmission lines, Southern California Edison's Right of Way & Land Department used electronic instruments, photogrammetric equipment, a helicopter and organized planning by a qualified consulting group to achieve the following advantages:

- Quick Results—The survey, which would normally have taken 60 days, was completed in 16.
- Accurate Data—Through the use of microwave measuring devices and theodolites, accuracies were achieved comparable to those which the US Coast & Geodetic Survey has established as the basis of control for geodetic purposes.
- Cost Savings—The use of photogrammetry supplemented the control work and replaced conventional topographic work, resulting in significant savings.
- A Refined Technique—The success achieved in this pioneering job has led to refinement and expansion of the technique to many other transmission lines and other surveys.

The end result of this method gave a definite survey with accurately controlled maps and photographs depicting the details of terrain, to allow line changes to be made with confidence.

The trial transmission line route selected was a 30-mile section of the SoCalEdison's proposed Santa Clara-Goleta 220-kv transmission line cutting through the Santa Ynez Mountains paralleling the Pacific Coast near Santa Barbara. The rugged route was to be closed to public use after July 1, 1960, because of prevailing hazardous fire conditions in the area. Field work was to begin on June 16 and the 30-mile survey had to be completed before July 1. Transportation problems in this area could be solved in many instances only by a helicopter and the route was selected while flying over the country which the transmission line was to traverse.

The route was selected from the best available maps, after which a reconnaissance flight was made to select physically the angle points and define the route on the ground. The helicopter carried two men and the pilot plus a tellurometer, theodolite and appurtenant equipment as described in the adjoining box. Due to numerous short hops required, 50 to 60 take-offs and landings were made each day to transport the survey personnel from peak to peak. The helicopter placed field crews in the area to premark the angle and vantage points, property corners and control stations. By using two-way radio communication between ground and air, the helicopter pilot was informed at all times of the transportation needs of the ground parties and thus was able to serve three working groups.

While one group premarked property corners, the other groups performed the necessary work with the tellurometer and theodolite. A theodolite was used at each end of the line in order to obtain simultaneous reciprocal vertical angles. By this method, it was possible to get good vertical results in rough country without the necessity of having to run time consuming differential levels. Thus, the field work was reduced.

The IBM 650 computer was used to determine trigonometric elevations and to perform tellurometer reductions. With the use of the company's program for the IBM 704, the traverse was computed and adjusted, obtaining the coordinates on all these stations.

A photographic flight was made over the area and vertical photographs exposed from an altitude of 6,000 ft. The necessary control information was transferred to these resulting photos and, by the use of the Zeiss Steroplanograph, photogrammetric bridging was performed. This information was then reduced by the Bendix G-14 computer. After proper adjustments, both vertical and hori-

CHANCE Clamps for Big Conductor

WIDE RANGE

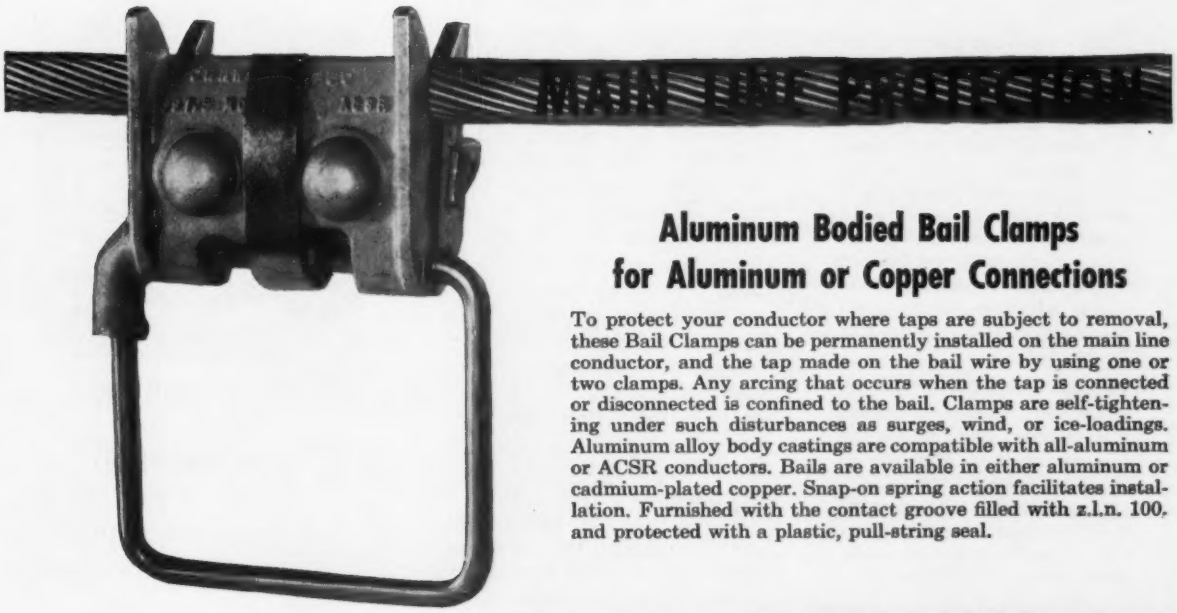
All Aluminum for Highly Corrosive Areas

Built for Heavy Duty

These All-Aluminum hot line clamps combine several advantages for heavy duty line construction. Their bulk gives them both the mechanical strength to withstand extreme tightening torque without distortion, and the ability to carry excessive current without heating.

The fact that all exposed surfaces are aluminum makes them the clamps to use in corrosive areas where other clamps might fail. Their conductor range for both main line (No. 2 to 397.5 MCM ACSR) and jumper (No. 4 Solid AWG to 397.5 MCM ACSR) makes them versatile clamps for many applications.

Important from the conductivity standpoint are the wide jaws with special "waved" contact surface, and the heavy terminal pad. To further insure good conductivity, these clamps are available individually packaged in polyethylene bags with Chance z.l.n. 100 Electrical Contact Aid pre-applied to contact surfaces. Price per clamp in lots of 100, $2.65. AGP (fortified cadmium plated) packaged clamps are also available, at $2.90.



Aluminum Bodied Bail Clamps for Aluminum or Copper Connections

To protect your conductor where taps are subject to removal, these Bail Clamps can be permanently installed on the main line conductor, and the tap made on the bail wire by using one or two clamps. Any arcing that occurs when the tap is connected or disconnected is confined to the bail. Clamps are self-tightening under such disturbances as surges, wind, or ice-loadings. Aluminum alloy body castings are compatible with all-aluminum or ACSR conductors. Bails are available in either aluminum or cadmium-plated copper. Snap-on spring action facilitates installation. Furnished with the contact groove filled with z.l.n. 100, and protected with a plastic, pull-string seal.

A. B. CHANCE COMPANY

CENTRALIA, MISSOURI

(A. B. Chance Company of Canada, Ltd., Toronto)

CC60-22

The principal instruments and/or equipment used on this survey were:
The tellurometer—an electronic device capable of measuring time in billionths of a second. It measured distances accurately and quickly, regardless of terrain. —Tellurometer, Inc; Capetown, South Africa.
The electrotape—an electronic device that did work similar to the tellurometer but is more accurate and can measure slightly longer lines, up to 100 miles in length. Cubic Corp, Los Angeles, Cal.
The Zeiss Steroplanograph—a photogrammetric instrument was used for making precise measurements from aerial photos. Zeiss-Aerotopograph, Munich, West Germany.
The Askania Directional Theodolite—determined vertical and horizontal angles to one second, without necessity of interpolation. Askania-Werke, AG, Berlin Friedenau, Germany.
The IBM 650 computer—reduced tellurometer survey data. International Business Machines.
IBM 704 computer—computed traverses and coordinates of survey points. International Business Machines.
A 305 HP Hiller 12E helicopter. Hiller-Helicopter, California.

zontal positions were determined for all points necessary to complete the photogrammetric mapping. The line was then plotted on the contour map and the profile determined.

In the IBM 704 program for the traverse, its adjustment and coordinating field survey data may be used directly or bearings and distances from a map or description may be used. If the data are from field notes, the program accepts slope distances, either chained or stadia; a temperature correction will be applied if the temperature is furnished; and scale and elevation factors will be applied if desired. If the traverse closes on a known bearing the angular error will be computed and distributed to the various courses. When the source data are in the form of bearings and distances (the distances may be either in feet or chains) and bearing equations are encountered, these will be applied as well as scale factors. Complete freedom can be exercized in using these adjustments as any number of courses may be held fixed and other courses adjusted to them. Area calculation may be performed on the unadjusted as well as on the adjusted traverses, and if curves are encountered, the sectors and fillets will be added or subtracted automatically, as required.

The experienced professionals participating included: Walsh-Forkert Civil Engineers, Inc, which was assigned the job of setting up and paneling transmission line angle points and recovering and paneling section line and property corners; Aerial Control, Inc, which established horizontal and vertical control for first order photogrammetric mapping; and Pacific Air Industries, which completed the necessary aerial triangulation and prepared a combination photogrammetric plan, topographic and profile sheets.

CIRCLE 42 ON READER SERVICE CARD

NEW

PENGO POLE-MOUNT TENSIONER

Now...PENGO 4000 Tensioner Takes Conductor to 336,500 cm-ACSR or 397,500 cm-AAC —Tensions to 1,000 Pounds!

Here's a bullwheel tensioner you can carry in every line truck! It features two 18 inch neoprene lined bullwheels. Tru-Stop disc brake – yet weighs so little it's truly portable.

Two men can easily place the 4000 PM against the pole, attach it (chains and wing-nut tightener are permanently attached to tensioner), and start stringing in a matter of minutes. Conductor can be payed off any suitable reel stand. A collapsible reel attached to a winch shaft makes a practical puller, although any type of power previously used for pulling can be used.

TENSION WIRE STRINGING is the safe, economical modern way to string distribution and transmission lines. Why not get the facts? Write for new PENGO catalog TSE-1 for full data on the world's largest, most complete line of tension stringing equipment. Please address Dept. 124.

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CIRCLE 95 ON READER SERVICE CARD→

SERIES ABS

"Sky-Master"

HYDRAULIC AERIAL BEAM

That's right, with the Series ABS Sky-Master workmen can reach out-of-the-way areas quickly and work on or near energized phase lines in complete safety.

Outer beam of the Series ABS is an extra-strong Spirex tube which withstands dielectric testing far in excess of normal requirements. Reinforced plastic work basket has no current-conducting parts or projections . . . provides ample work space and toe room for the operator.

Control levers beside work basket are connected to those on the mast by direct linkage, giving the operator a positive "feel" not possible with secondary hydraulic control-actuating systems.

Dielectric, reinforced plastic rods are installed in the control linkage and basket leveling mechanisms to electrically isolate the basket from the ground.

Modern way to work on energized high voltage lines

The Series ABS is fully-hydraulic in operation, powered by a pump driven by a power take-off on the truck transmission. Outer beam movement in an operating arc of 270 degrees and inner beam movement through a 110-degree arc is independently controlled. Mast can be rotated continuously in either direction. Safety devices prevent unwanted movement when controls are in neutral or if hydraulic system is damaged.

Maximum ground-to-basket floor height is 42′—enabling men to work safely and without fatigue up to 47′ above ground. Wide range of operation permits spotting of the work basket in limitless positions in any direction from the truck. The Series ABS, installed on a Powers-American Body that fits your work needs, can be furnished in two models; Series ABS-1-42 having one basket, Series ABS-2-42 with two baskets.

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ELECTRIC UTILITY METHODS

E u m

OPERATIONS & TESTING

Static Logic Circuits Control

J. C. **FOSS**, Section Engineer, Commonwealth Edison Co, Chicago
G. E. **FOSTER**, Chief Engineer, Lundell & Co, Chicago

Use of static logic circuits in place of interlocked auxiliary contacts is an innovation marking the installation of new coal-handling equipment, central control board and associated controls at Crawford Generating Station of Commonwealth Edison Co. This new approach to control of a coal handling system has these immediate advantages:

- Control lead requirements are materially reduced.
- Routine checks of the status of circuits or devices may be made using only a voltmeter.
- An over-all check of the entire control system logic can be made at the factory prior to installation.
- Space required for the control board is cut by two-thirds.

Economic analysis indicates that the additional cost of the static control system over a conventional system is more than offset by the saving in control leads and conduit. This installation also provides an opportunity to evaluate static devices for future control systems designed specifically for static components. Such completely static systems could provide additional annual savings by eliminating maintenance of coils and contacts.

The static control system provides a completely interlocked permissive starting sequence so that all equipment in any one coal flow path must be operating before coal can be fed into that path. A piece of equipment can be started only if all downstream equipment already is operating. Sequential mandatory automatic tripping prevents coal from being fed into non-operating equipment. If any equipment stops, then all upstream equipments are automatically tripped.

To accomplish these operations with a conventional control system would require intelligence for the interlock connections through auxiliary switches on the main power devices. A separate auxiliary switch with a separate pair of control leads would be needed for each interlocked function. Because the permissive starting and the sequential tripping interlocks require many interconnections between devices, this would result in a very large number of auxiliary contacts and literally thousands of conductor-feet of control leads.

One way of reducing the number of auxiliary contacts and conductor feet of control leads is the use of one auxiliary contact on a device to actuate a centrally located multi-contact relay. While this approach reduces control lead requirements, it merely relocates but does not reduce the total number of contacts and actually increases the number of relay coils. These devices inherently have a finite life and require continuing maintenance. Furthermore, this type of control system perpetuates equipment which could well become obsolete early in the planned 35-year life of the installation. Therefore, the use of static devices was studied as it was felt that they now are technically and economically feasible for many control functions.

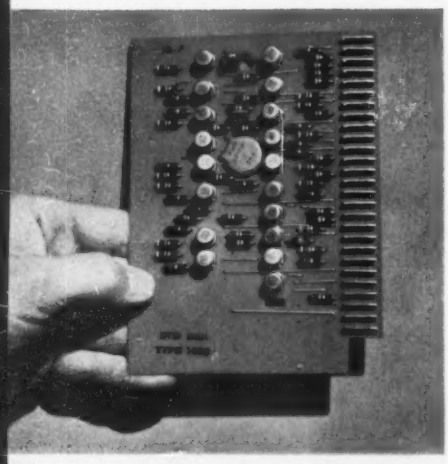
For the Crawford Station installation, because of the short time available for design, static logic circuits were considered as direct substitutes for interlocked auxiliary contacts on main power devices. No attempt was made to develop a complete system designed specifically for all possible advantages of the state concept.

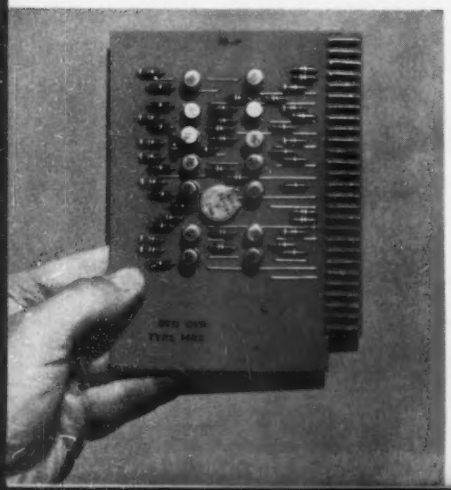
For the functions required, a multi-input, single-output static logic circuit was found to be feasible. Also, relatively economical, low speed transistor logic system was chosen.

A voltage logic system was selected because the state of system can be readily determined at any time by simply using a voltmeter.

In designing the logic circuits, it was evident from diagrams for a conventional relay-type control system that if more-or-less direct circuit substitution was to be followed, logic circuits for AND, OR, and NOR functions would be required. From these basic circuits could be constructed the logic circuits previously expressed as interlocked contacts. How these circuits perform is shown in the accompanying diagrams.

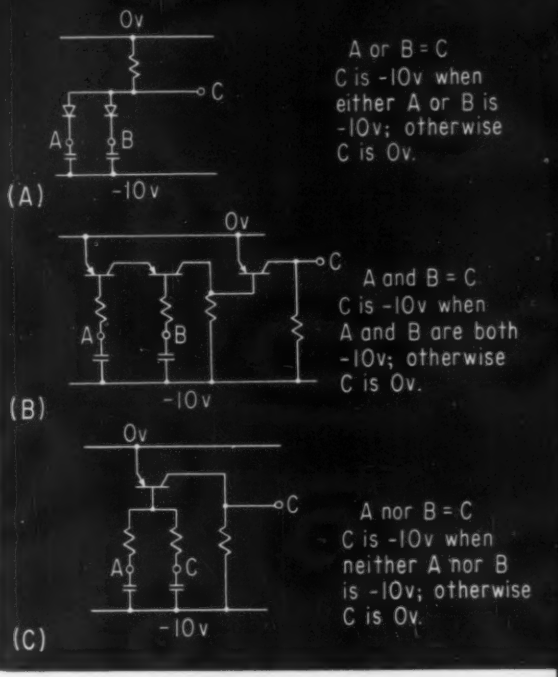
These three circuits furnish all of the system logic, with remaining circuitry required only for





STANDARD ASSEMBLIES on plug-in cards provide all the parts associated with a given power device. The circuit-breaker card (above) and the contactor card (below) are two of only seven different cards required for the entire system

Coal Handling System



input and output requirements. For example, the interconnection between system logic and breaker and contactor control circuits is accomplished with a coupling card used as a dc-to-dc transducer. This coupler provides about a 10-v output whenever the control bus potential is applied to the input. In addition, a power amplifier is required for operating either pilot lights or output relays. This amplifier circuit is used throughout the system to furnish information visually to the operator or electrically for operation of main power devices.

A standard assembly on a plug-in card provides all device logic, interlocks, memories, and control associated with and necessary to operate either a breaker of a contactor. Hence, a definite circuit can be isolated readily for maintenance purposes. The two cards designed for this purpose are illustrated

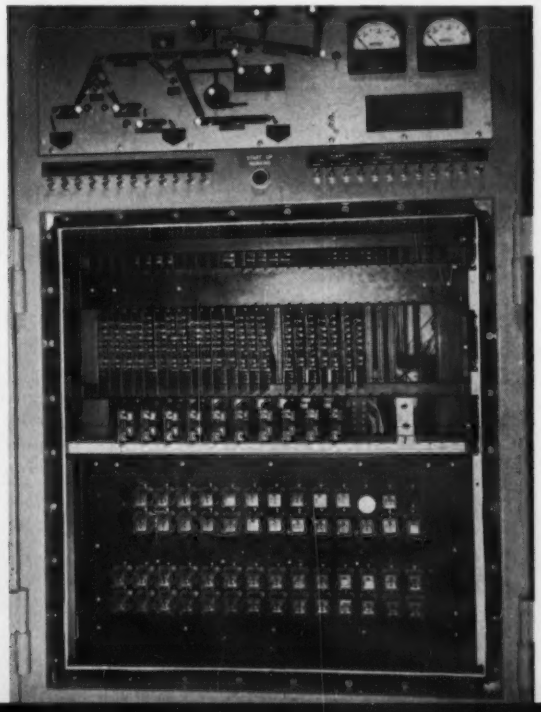
All system logic circuits also are constructed on small plug-in cards. Thus, only seven different cards (one each for a NOR, an OR, an AND, contactor control, breaker control, power amplifier, and coupler) are required for the entire system. These are conveniently mounted and cross-connected in racks fed by a common power supply. Cross-connections between any logic circuits are made simply by running single wires between the cards. This is much more economical than running a pair of wires for each relay contact and coil.

LOGIC CIRCUITS for the static control system perform OR, AND or NOR functions. Voltage levels of 0 v and 10 v are the logic levels. For the logic statement, a voltage of 0 is taken as NO and a —10 v is YES. Thus the logic OR circuit (A) has YES output at C if either A or B inputs are YES; otherwise the output is NO. The logic AND circuit (B) has a YES output at C only if both A and B inputs are YES; otherwise the output is NO. Logic NOR circuit (C) has YES at C when neither A nor B are YES, otherwise NO

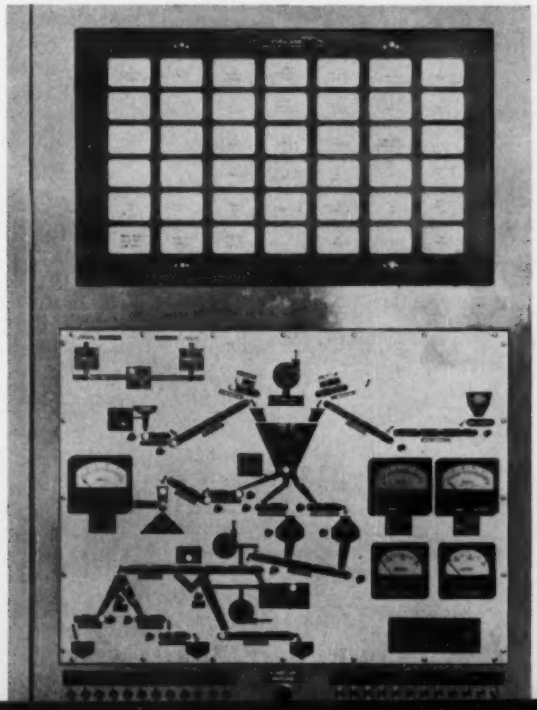
The control panel is arranged as a graphic representation of the coal-handling system. Because the logic components require only about 1 ma for actuation, miniature switches are used for control. Even though the

(Continued on page 104)

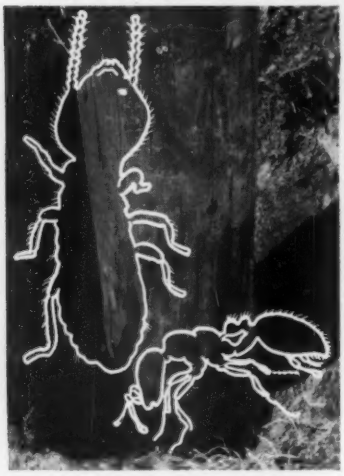
SYSTEM LOGIC CIRCUITS on plug-in cards are mounted in racks and fed by common power supply. Cross-connections are made with single wires between the cards



SWITCHES AND LIGHTS on the control board are mounted in relation to the equipment they control to graphically indicate coal flow and service equipment



DON'T LET THESE ENEMIES RUIN YOUR POLES



Osmose TRI-WAY
Ant & Termite Treatment
STOPS 'EM DEAD

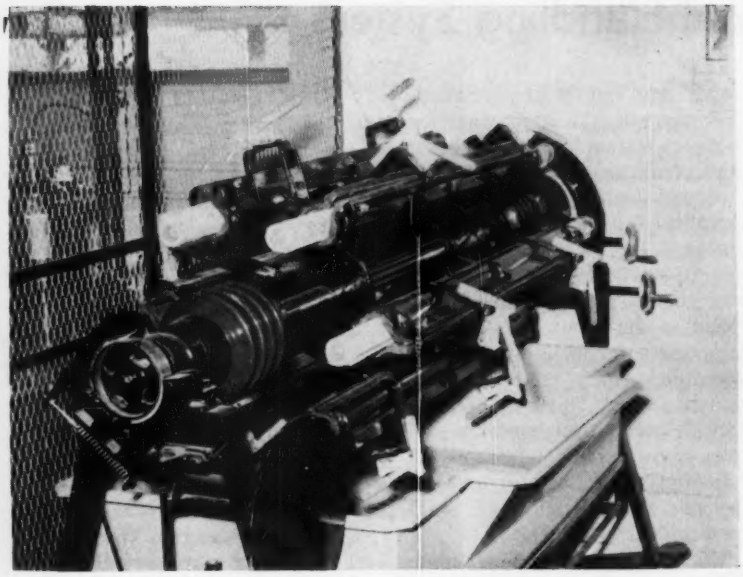
Ants and termites are playing a more prominent part in wood pole destruction in areas where they were never before considered to be an important factor. But here's good news . . . the assurance that ants or termites can be eliminated from standing poles wherever infestation occurs.

The Osmose Research Division has developed a new, powerful injection solution which acts positively and effectively through three components: (1) An insecticide known for its permanent effect; (2) An insecticide capable of generating active toxic vapors which will reach areas not directly contacted by the solution; and (3) A wood preservative which is included to stop decay in those areas reached by the solution itself.

Guard against this potent danger to pole life and safety. Osmose field crews are prepared to apply TRI-WAY Ant and Termite treatment as a part of their regular groundline inspection and treatment service wherever needed. Here is the most thorough . . . the most dependable groundline service you can obtain. Get protection, safety and long-lasting economy the proven OSMOSE way. Write Osmose Wood Preserving Co. of America, Inc., 991 Ellicott St., Buffalo 9, N.Y.

OSMOSE

SERVING UTILITIES SINCE 1935



Rack Speeds Line Hose Tests

J. L. COPPER, Florida Power & Light Co, Miami, Fla.

Testing rubber line hose has been speeded up in the Florida Power & Light Co by a specially designed test rack. Furthermore, the test stand insures the safety of the operator at all times.

A lathe-revolving rack, supporting six split metal tubes, is suspended on insulators—various size felt liners fit into the metal tubes. A tank containing water is located beneath the test rack. This tank may be raised so that the tube felt liners are completely saturated with water as the rack is rotated. After the felt electrodes are soaked to give good electrical connection, the tank is lowered out of the way, and the line hose is placed over the inner electrode. This electrode consists of chrome-plated tubing with pressed plastic ends. One of the ends has a ground connection brought out through the plastic.

The line hose, assembled over the inner electrode, is then placed inside one of the metal tubes which in turn is clamped shut. The rack may then be rotated for placement of the next line hose.

After the rack is loaded, it is locked in position. A crank, which locks the rack in position, achieves the high-voltage connection, as well as the six ground connections — simultaneously with constant pressure contacts.

When testing is ready to commence, the operator closes the safety gate. This safety gate opens the mechanical ground connections and closes the high-voltage interlock circuit—allowing the operator to apply test voltage at will. The ground side of the hose may be individually switched through a meter for leakage readings. The test panel automatically de-energizes and sounds an alarm when any test failure occurs, thereby allowing the operator to determine quickly which hose has failed.

Adjustable outer felt liners and different size inner electrodes allow this unit to test all the different sizes and types of line hose used by Florida Power & Light Co in a minimum of time. The test stand occupies a very small section of test area.

(More Operation on p 103)

Your best conductor protection is **ARMOR RODS**
and the best armor rods are

FANNER Superforms*

SUPERFORMED BY THE WORLD'S FIRST MAKER OF MACHINE-MADE ARMOR RODS

plus values in
RESEARCH/DEVELOPMENT
Punishing tests, indoors and outdoors, are constantly conducted for product improvement and new developments.

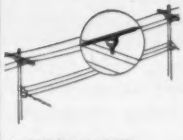
plus values in
RAW MATERIALS
Exacting tests and material inspection assure the finest quality in all Fanner Superformed products.

plus values in
PRECISION MANUFACTURE
Scrupulous care in manufacturing, in testing, in handling and in packaging assure on-the-job dependability.

Of course you use armor rods for their economy and safety in construction, maintenance and repair of overhead lines. But, above all, you buy them because they are the most *dependable* accessory yet developed for protecting overhead conductors against wind-induced vibration at supporting points.

Fanner Superforms are of the highest quality. At every step . . . in development, materials, manufacture and packaging . . . Fanner takes extra care to give you the finest armor rods available, *at no extra cost.* Ask our representative for details. He will give you *plus assistance with your T&D problems,* too!

ARMOR RODS
. . . Protect long spans at supports



LINEGUARDS
. . . Protect short spans at supports

FANNGRIPS
. . . For dead-ending strands or conductors

FANNSPLICES
. . . For joining or patching strands

TREEGUARDS
. . . Protect conductor surface covering

KOVER-GARDS
. . . Protect surface-mounted conductors

*A superior forming method in accordance with Patents No. 2,769,478 and 2,588,663—other patents applied for.

THE FANNER MANUFACTURING COMPANY
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DIVISION OF TEXTRON, INC.

Fine Fanner Superformed Products

A-3605A

ENGINEERED INTO
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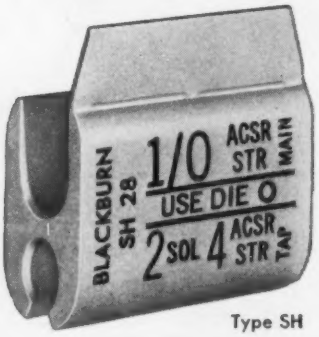
COMPRESSION CONNECTORS

High Conductivity-

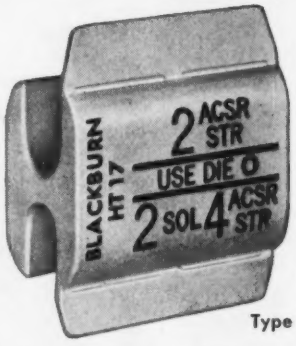
Blackburn has engineered all compression connectors shown to fit your present tooling program—and added advantages to meet engineers' and linemen's requirements.



Type SH

Type HT Prefilled

Type SH Prefilled

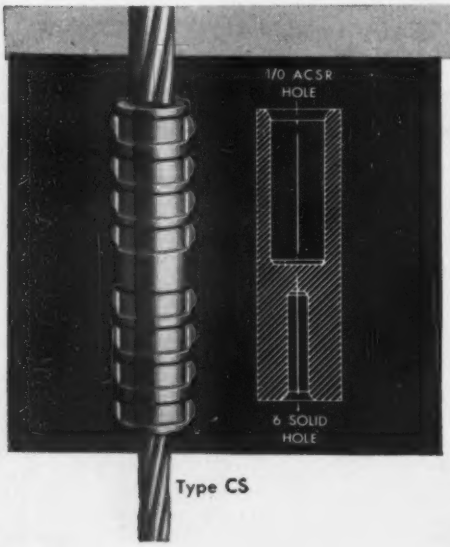


Type HT

Standardization now possible with Blackburn "H" frame connectors

- **Designed to fit the tools you already have for applying "H" frame type connectors.**
- **Full length tab completely seals out moisture, easiest to bend and install!**
- **Surface treated to improve conductivity and retard corrosion.**
- **Prefilled with Blackburn's superior oxide-inhibiting compound, Contax, in easy-tear tab vacuum package.**
- **Color fast, large, easy-to-read lettering.**
- **Type HT is reversible, both grooves "open". For large aluminum tap to smaller copper main. Also used for dead ending.**

Licensed under U. S. Patent No. 2,707,775



Type CS

You get higher conductivity with Blackburn service entrance sleeves

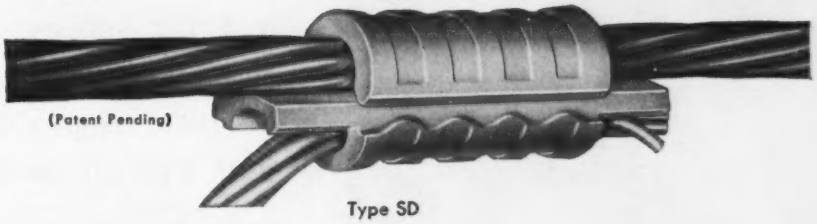
Blackburn—and Blackburn *alone*—provides greater contact area where needed, to assure greater conductivity. This is accomplished by increasing hole depth as the diameter of the conductor is increased, thereby providing more contact area for the conductors being connected.

The Color Coding is *printed* for quick, positive identification.

The sleeves' ends are sealed with Aluminum Sensitized Tape, which is easy to puncture . . . and, if a particle of the seal is pushed into the chamber, the particle is conductive.

Contax, Blackburn's superior oxide-inhibiting compound, is already in these sleeves *in measured amount.* Won't squirt out on glove or in face. And the solid center stop in a Blackburn Sleeve assures proper distribution of the inhibitor around the conductors. Designed for tooling you have.

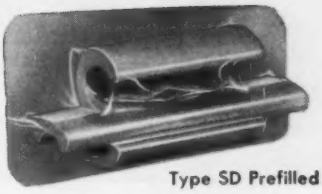
High "Use-Ability"



Type SD

Exclusive drip-guard separator in Blackburn 6-frame tap connector gives *extra* protection to bi-metallic connections

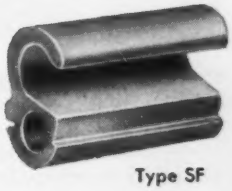
- Spacer allows SD Connector to be used for bi-metal connections with the tools you already have for "C" Frame type connectors.
- An economical substitute for "L" taps, since extended drip guard gives extra insurance against corrosion products bridging the bi-metallic gap.
- A true *two-handed* connector, very adaptable for hot line work.
- Surface treated for highest conductivity and corrosion resistance.
- Prefilled with Blackburn's Contax and vacuum packed for insurance against corrosion.



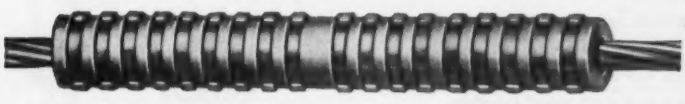
Type SD Prefilled

Type SF

- Recommended for aluminum to aluminum.
- Spacer gives better protection against strand breakage.
- Can be installed with same tooling used for Type SD.
- Prefilled with Blackburn's Contax and vacuum packed for insurance against corrosion.



Type SF



Type TR

Blackburn neutral repair sleeves save dollars on triplex services

- Salvage short lengths of pre-assembled service drop cable with Blackburn Sleeves.
- Designed for and tested with the tools you already have.
- Extra length engineered for neutral pullout values in keeping with dead end devices.

See JB Catalog 858 for Tooling INFORMATION

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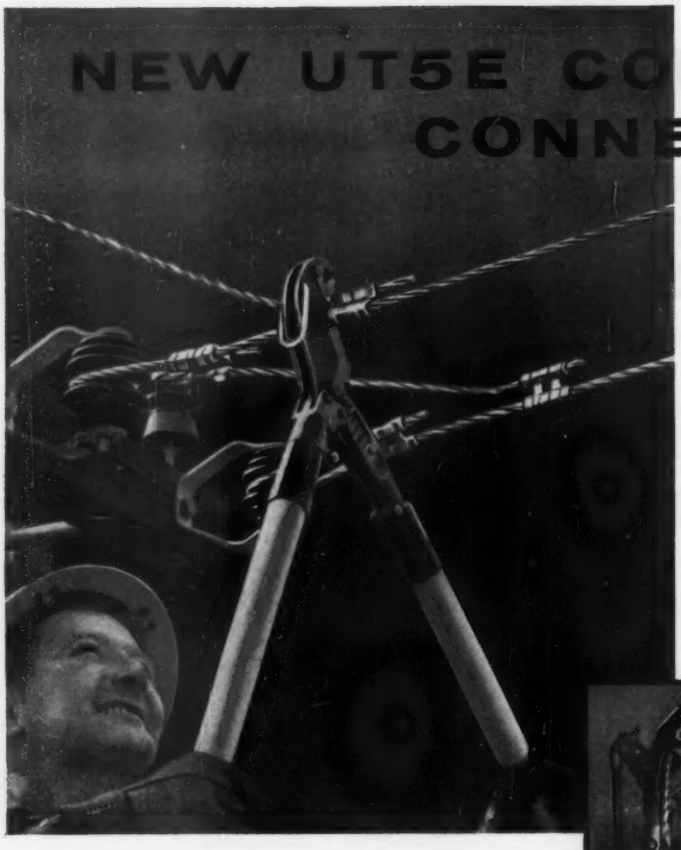

NEW UT5E COMPRESSION CONNECTOR TOOL

PATENTED

INSTALLS THE BIGGEST CONNECTOR RANGE EVER!

one mechanical compression tool that splices, taps, dead-ends, and terminates the complete range of conductors from #10 str. to ~~4/0 ACSR~~ 336.4 (18x1) ACSR, 350 MCM All Aluminum!

HOT LINE APPLICATION

QUICK! One stroke makes one perfect compression.

LIGHT! Complete tool weighs only six pounds!

SIMPLE! C-Shaped head with snap-in, color-coded dies is designed to simplify the job.

SAFE! Tool and connectors are designed with safety in mind.

ECONOMICAL! Priced at a small fraction of the cost of hydraulic tools. Rugged construction means long service life. Tool adjusted with a common wrench.

The following compression connectors are available for use with the UT5E tool:

Tension Splicers • Service Splicers • Loop Splicers • Single Sleeve ACSR Splicers • Angle Tap Connectors • PALTAP† Connectors • TWINTAP† Connectors • Aluminum Terminals • Aluminum Copper-Pin Terminals • Aluminum-Copper Pad Terminals • Adjustable Dead Ends

The UT5E tool is available in the following combinations:

CATALOG NO.	DESCRIPTION
UT5E	Basic tool with metal handles
UT5W	Basic tool with wood handles
UT5H4	Basic tool with 4 ft. hot stick handles
UT5H6	Basic tool with 6 ft. hot stick handles

Patents and Patents Pending on the above items

†Trade Mark

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PLEASE SEND ME:

- ☐ The New T&B Bulletin D59 for *Distribution*: Connectors, UT5E Tools, and Accessories.
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COMPRESSION CONNECTOR MANUFACTURERS SINCE 1940

Scooter Proves to Be Service Center Asset

Georgia Power Company's over-sized motor scooter has proved so successful at the new service center that it is virtually on a 24-hour schedule. The scooter is used during the day for deliveries of mail, and small materials, supplies and packages between the building. At night the scooter is used by one watchman to do the work of a number of men.

The scooter is electrically operated and has a cab enclosure to protect the driver from the weather. A small truck-like body is large enough for the handling of mail and a few small packages.

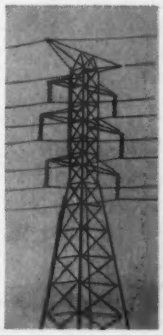
The service center is large and has three buildings that are widely spaced to provide room for growth. Gates to the service center are locked at night. When a car or truck comes to the gate the driver sounds a horn and with the scooter the night watchman returns quickly to the gate and unlocks it.

Each gate has a distinctive horn so the watchman knows where to go when the horn sounds. With the scooter one watchman can cover the entire service center area at reasonably frequent intervals.

Without the scooter two watchmen would probably be required. Even so, it would be necessary to have additional men at the gates because on foot it would take too long and be too tiring for either of the watchmen to return to a gate to open it every time a car or truck arrived.

On Crossarm With Added Angle Attachment **With Pole Bracket**

67½°-90° Angle Attachment and Pole Bracket are accessories.



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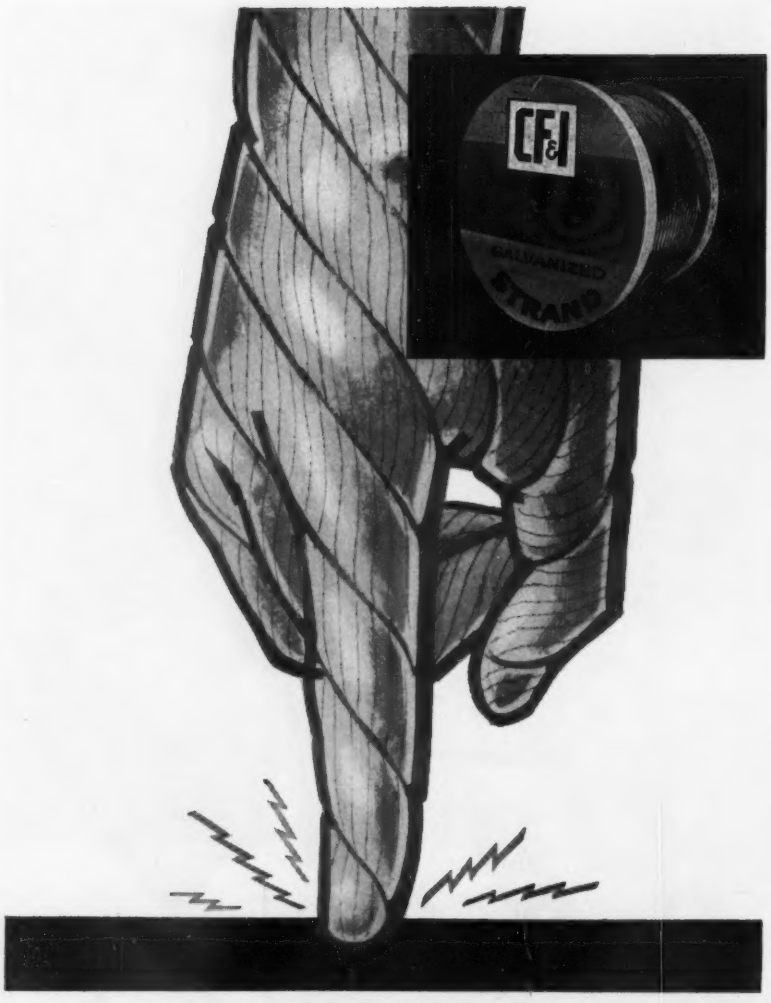

Ground
the destructive force
of lightning with

CF&I Galvanized Steel Strand

For grounding of power transmission lines, CF&I Galvanized Steel Strand has been proved by years of experience. Weldless Overhead Ground Wire Strand is made of special analysis steel to ASTM specification A-363, in three- and seven-wire constructions. It is carefully galvanized for extra weather resistance.

For guy, messenger and other applications, CF&I Strand is made to ASTM specification A-122. CF&I can also manufacture strand to your individual specifications. For prompt delivery, see your local electrical distributor or contact the nearest CF&I office.

CF&I STEEL

GALVANIZED STEEL STRAND
THE COLORADO FUEL AND IRON CORPORATION

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In the East: WICKWIRE SPENCER STEEL DIVISION — Atlanta • Boston • Buffalo • Chicago Detroit • New Orleans • New York • Philadelphia • CF&I OFFICE IN CANADA: Montreal
CANADIAN REPRESENTATIVES AT: Calgary • Edmonton • Vancouver • Winnipeg

Coal Handling

(Continued from page 97)

basic semi-conductor circuitry is low voltage, all circuits involving contacts external to the transistorized section of the control operate at 125 v. This voltage insures good contact on the external switches even though the current is limited to about 1 ma.

One advantage of the static control system became apparent when the design was developed, namely, an over-all system check could be made at the factory. All system logic is contained in the main control board. Field equipment, consisting only of main power devices and limit switches, can be simulated with relays having a single contact for feedback to the logic circuit. As a result, the over-all logic was completely proved at the factory. This saved considerable time during field installation because it was known in advance that the basic sequences were correct.

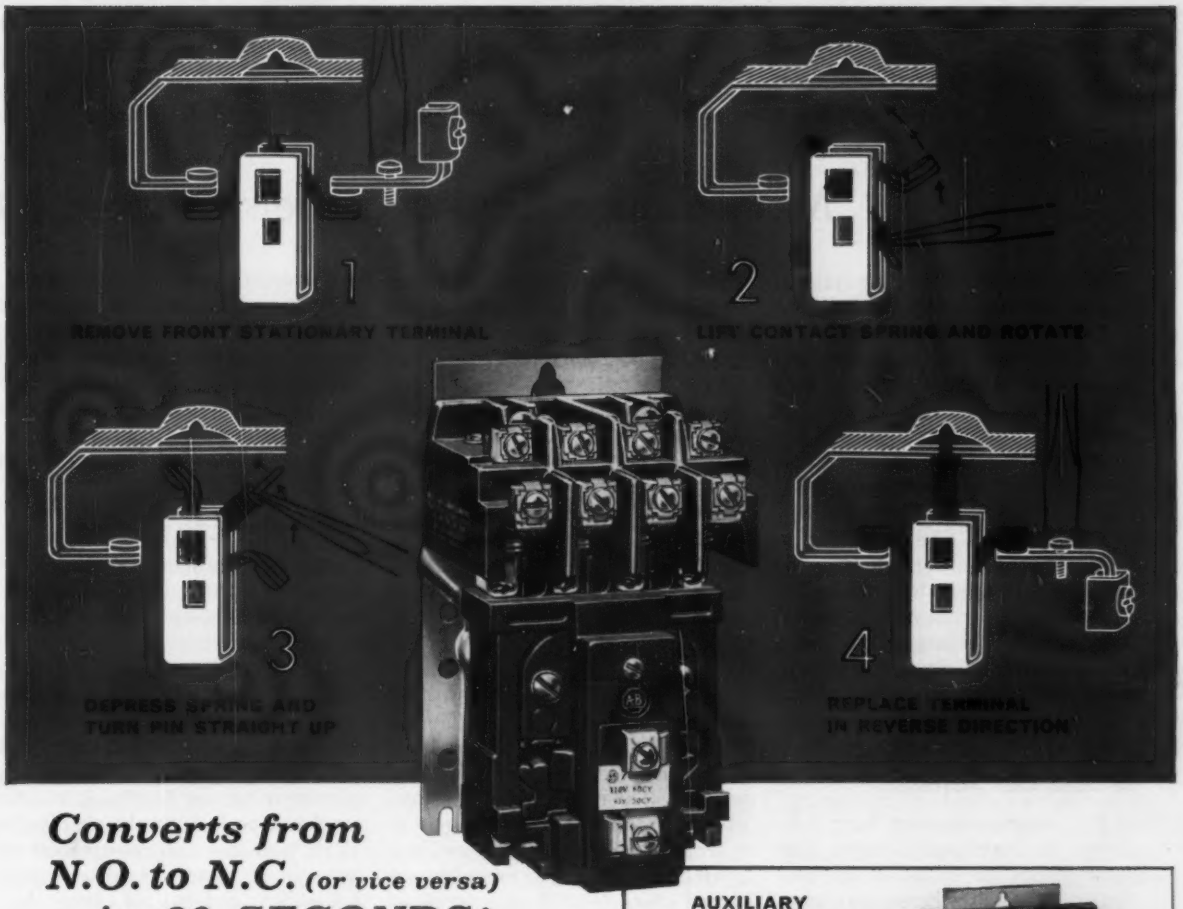
After the circuits had been designed, it was evident that the static control approach has other advantages. Once the number and size of motor drives is determined, the main power devices can be ordered without waiting for control requirements to be determined. Similarly, because the same number of control leads is used for either a contactor or breaker, the size and amount of control cable can be estimated readily and immediately ordered.

The establishment of interlocks between equipment is extremely easy because all logics have a common operating voltage. It makes no difference whether the end device is dc or ac operated. The cross-connection between the two is made without any problem. Because the basic logic is relatively easy to set-up, the equipment was designed in about 8 weeks.

A major factor inherent in any centrally controlled system is the floor space requirement for the control board. A board for the Crawford Station coal handling system designed for relay control would take about 53 sq ft. The static control board requires only 18 sq ft of floor space, one-third that of the relay board.

Four simple steps to contact changeover

Total time—not more than 60 seconds



Converts from N.O. to N.C. (or vice versa) in 60 SECONDS!

You'll be truly amazed at the ease of converting the contacts on these Allen-Bradley Bulletin 700 Type BR relays. Using only a screwdriver, as shown above, the contacts can be changed from N.O. to N.C. (or vice versa) in four easy steps—that take only *60 seconds!* Such convenient flexibility is a "natural" for reducing relay inventories.

The Type BR relays are built to provide *many millions* of trouble free operations. With the built-in permanent air gap, magnetic sticking is impossible. And the molded coil is impervious to *all* harmful atmospheres. Of course, the double break, silver contacts *never* need attention. If you use relays, there are money savings for you in the Type BR relay line!

AUXILIARY CONTACTS EASILY ADDED

Type BR relays are available with 2, 3, 4, or 6 poles—but as a valuable bonus, one or two fully rated poles can be added to the base of each relay—even in the field. It's a simple addition that takes only moments.

ALLEN-BRADLEY | *QUALITY MOTOR CONTROL*

Member of NEMA

Allen-Bradley Co., 1327 S. First St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

At Oakland driver notes failure in vehicle. He then fills out a "complaint" slip and takes to shop foreman, who reviews history card

Maintenance Control System Evolves Into

What started as an improvement in record-keeping at Pacific Gas and Electric Company's Automotive Department has led to development of a system aimed at keeping fleet management better informed on maintenance and repair cost trends in the San Francisco-based utility's far-flung fleet of more than 5,700 vehicles. In the approximately 90% of PG&E shops where the system has been put to work so far, the result has been better spacing of routine maintenance, prompt awareness of chronic or recurring troubles on a vehicle or class of vehicles, and, most important, providing of a bird's eye view of man-hour expenditures.

Reduced Cost Motivates

The system was not born full-grown; it developed because fleet management at PG&E—like fleet management elsewhere—was concerned about costs in general and about improving control of maintenance in particular.

The utility's fleet, spread out over thousands of square miles of northern and central California, provides a substantial maintenance challenge. The basic method of maintenance record-keeping is to maintain a dossier on each vehicle at its "home" shop, consisting of "job tags" dropped into its folder whenever an item of maintenance or repair is performed.

The job tag is still the basic document for cost and labor accounting at PG&E. But because of its shortcomings in reflecting trends it is being supplemented with a more graphic medium.

Punched Card Evolves

Initially, a "complaint history card" with space for all necessary entries was devised as the new basic identification of each vehicle's maintenance record. Utilizing space-saving codes and abbreviations to a great extent, the cards provide a chronological, concise maintenance record which local shop supervisors are instructed to maintain carefully and consult before any maintenance job is done—this, to determine whether a similar job has been done previously on the same vehicle, and if so, how frequently and when the last repair job was performed.

Since codes and abbreviations used on the history card can be meshed easily into a conventional IBM punched card system, PG&E did just that as the second basic step.

Here is how the new system works.

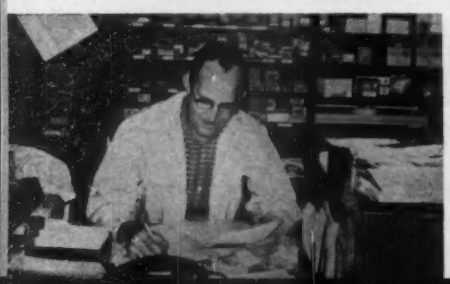
'Card' Processing is Simple

A "complaint order form" is filled out by the driver or by personnel at the shop where a vehicle is headquartered. The shop foreman reviews the record on each vehicle recommended for maintenance before ordering a job done.

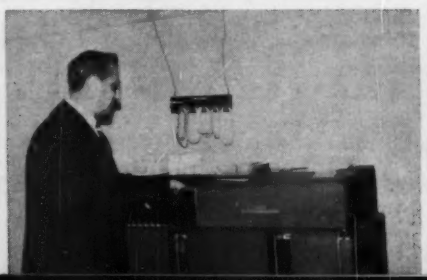
When the specific item or items of maintenance are completed, proper notations are made by the mechanic on the complaint order. A clerk transfers this information to the vehicle history card. Original complaint orders are then forwarded to department headquarters in San Francisco for punch card proceeding.

At San Francisco, an IBM "master card" has been punched for each vehicle in the fleet. The

Parts clerk enters work performed, in short coded form, on vehicle history card. Card is refiled at local office and complaint slips are . . .



mailed to data processing section in San Francisco, where information contained on complaint slips is key punched by hand onto IBM card



A permanent history card for each PG&E fleet vehicle is maintained, containing a complete identifying description of its related vehicle

If "chronic" series of failures to one system is involved, foreman may order replacement of ailing parts; otherwise, he orders repairs

Mechanic notes on complaint slip each unrelated repair job performed and time it took—foreman verifies that recorded info is correct

Foreman brings complaint slip and vehicle history card to parts department where parts clerk transposes, from slip to card, work performed

Precision Tool for Fleet Management

card denotes, in addition to vehicle number and assignment and location, the type of vehicle, year, make, body type, type of drive, special and accessory equipment. The first 49 of the 80 positions on the card are taken up with this data.

Complete History Available

For each item of maintenance or repair a seperate "detail card" is punched, in positions 50 through 80, based on the information contained in the complaint order. Permanent identifying information on the appropriate master card is gang-punched into the detail cards after the cards have been mechanically collated; the master card is then returned to file while detail cards are accumulated for quarterly runs. Detail cards will be kept two years, their data accumulated. An almost unlimited number of types of tabulations can be made on a given run of cards.

Some of their early findings were surprising to the five-man staff which operates the system. It was discovered that in one district 22 per cent of the total number of man-hours expended in one quarter to maintain one class of vehicles went into washing, and that overall car washing expenditures varied greatly among districts. In some areas washing proved to be the most costly single item of maintenance. PG&E has installed high pressure washing equipment in some locations as a means of remedying the situation.

Cost Analyses Achieved

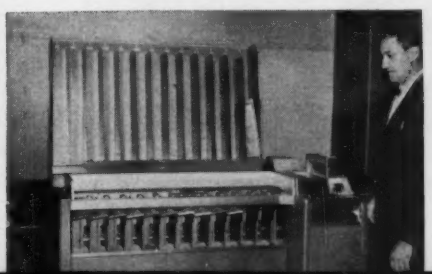
Also to be watched is the rate of clutch and transmission repair—for signs indicating it would be cheaper to switch in certain instances to automatic transmissions. But excessive repair efforts in certain situations can have interesting causes. In one shop the foreman had long complained of chronic overwork, but inspection of his records indicated he was failing to make regularly scheduled preventive maintenance checks on all his vehicles. This clue tied right in with an excessive amount of brake work that he was forced to perform.

Unusually high frequency of repairs to electrical systems of older trucks in one district was discovered, which immediately led to an investigation of the cause. In checking complaint history cards of the involved vehicles, automotive department chiefs found that unauthorized signal equipment was being installed on some of the vehicles, thereby increasing the cost.

Personnel Considered

As with the introduction of any new method, personnel relations had to be considered and faced with intelligence, sincereity, and tact. For instance, when one foreman complained about having to fill out a complaint slip every time a vehicle was washed, management simplified the problem by designing a rubber stamp which puts all pertinent wash-job information on the complaint slip, short of the date, motor vehicle number, employee, and hours spent. The fact that vehicle maintenance data which is readily available with the new system can be used as a tool by shop foreman to eliminate continuing-type vehicle headaches, generally has won over the slow changers.

Card sorter is used for quarterly runs. Sorter separates cards by division, shop, type of repair done, type of vehicle, and other breakdowns



Standard accounting machine prints out quarterly maintenance report which is circulated back to local area shops for study and information . . .

. . . Reports are scrutinized in the local main office. Maintenance procedures are quickly modified accordingly

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THE AMERICAN POWER-PULL HOIST-PULLER

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- Release or apply tension
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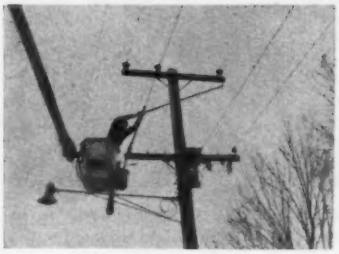


Air Hammer

G. H. DAVIS, Division Supt, Connecticut Light & Power Co, Berlin, Conn.

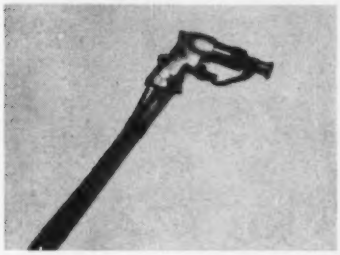
A small air hammer on a hot stick allowed linemen of Connecticut Light & Power Co to quickly and surely rate the degree of deterioration of arms on a 3-mile stretch of 28-kv energized line.

Since the line could not be taken out of service without total interruption to the area served, the line maintenance crew resorted to visual inspection of the 8 and 11-ft creosote-dipped fir arms. However, an outbreak of broken crossarms indicated that visual inspection was here inadequate.

To test effectively the arms on the line without interrupting service, a small 4-lb hammer was attached to an 8-ft hot stick. A rubber air hose taped along the stick, supplied air to the hammer through an on-off valve, at the lower end of the stock. Air was supplied with a small portable compressor.

A lineman working from the bucket of an aerial lift truck ran the hammer along the sides and bottom of each arm without coming near the live circuits. The sound of the hammer-tapping gave excellent indication of the condition of the arm. It was possible to rate the arm as "good" — "doubtful" — "rotted"—"dangerous," with a high degree of sureness.

The arms on all 110 poles along public roads were tested in

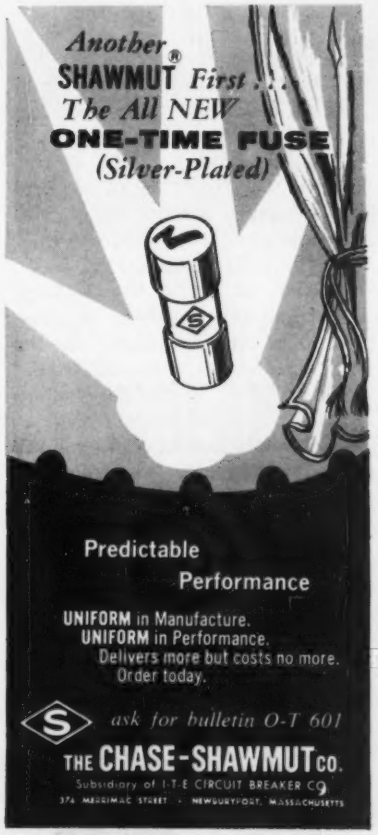


Tests Crossarms

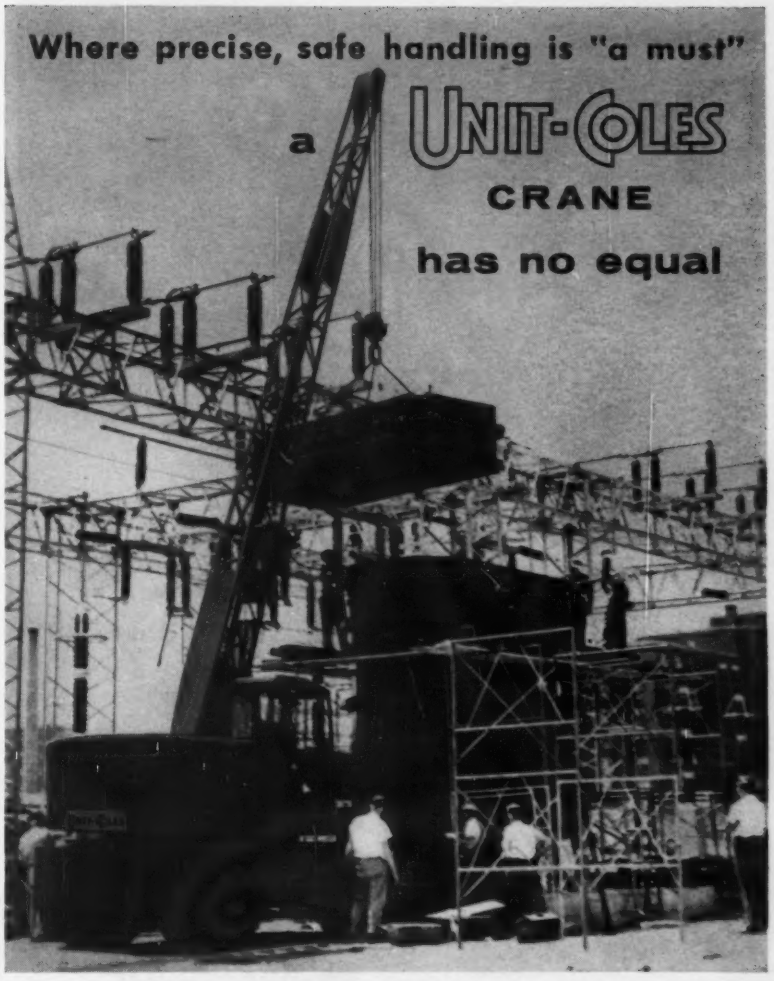
four days; 41 arms were indicated as "rotted," 7 showed "dangerous."

Later inspection of these 48 arms, as they were removed, showed that the test method used had been very accurate.

(More Maintenance on page 110)



CIRCLE 132 ON READER SERVICE CARD



■ Substation repair or renovation often involves handling expensive, damageable electrical components in energized areas. Because there is no margin for error, precise handling with safety is "a must". On both counts — accuracy and safety — a UNIT-COLES crane offers you unmatched advantages.

■ Generating its own power by means of a gasoline or diesel engine, the UNIT-COLES crane is electrically controlled and operated. Individual electric motors provide fully independent or combination control of all crane motions. The crane operator has infinite speed control at his command. He can raise or *lower* a load at less than a foot per minute with pinpoint precision, or run "wide open" at speeds up to 150 f.p.m.

■ Utmost safety is assured by a positive-action Safe Load Controller with a "stop and hold" function that automatically prevents overloading. Easily adjustable limit switches, by prohibiting dangerous over-travel, assure that load and boom avoid nearby "hot" lines. These outstanding safety features together with "fail-safe" *automatic braking* and "*dead-man control*" on all crane motions make a UNIT-COLES *the world's safest crane.*

■ UNIT-COLES cranes, self-propelled or truck-mounted, are available in capacities ranging from 5 to 55 tons. Why not take a tip from the scores of electric companies who have already found *this crane* to be *the perfect answer* to their handling needs? Write today for full details!

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They're Safe, Clean to Climb and Deliver Many Added Years of Trouble-free Service

LIFE-SPAN Western Red Cedar Poles are clean and protected from top-to-butt. They are the result of years of continuous research and are **completely** immune to decay. To serve the utility industry better, Page & Hill maintains three mechanized yards with modern handling equipment. The LIFE-SPAN treatment applied to P&H poles complies with all approved E.E.I. or A.W.P.A. Thermal specifications.

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110 CIRCLE 110 ON READER SERVICE CARD

Special Platform Aids Mechanics

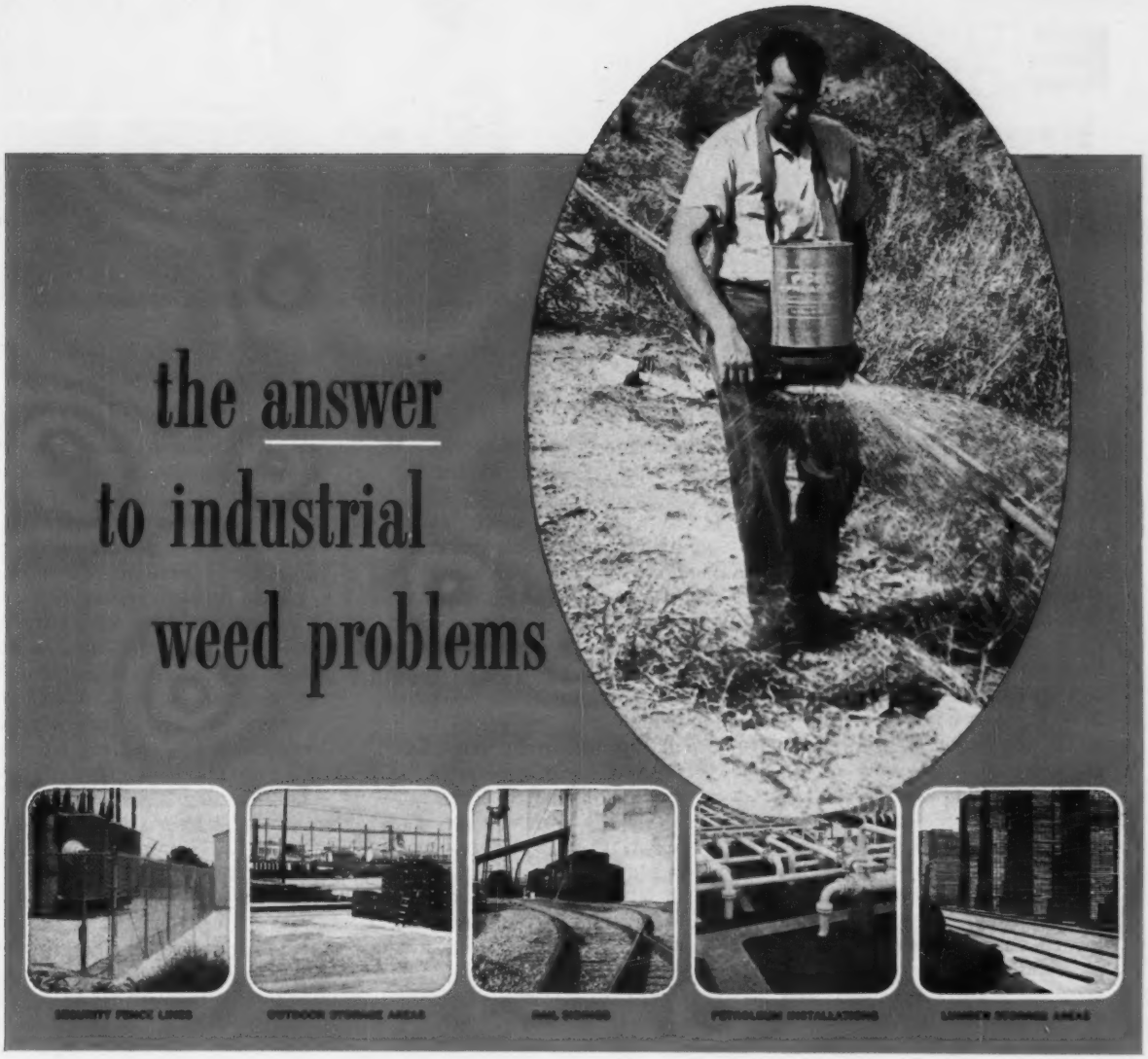
In order to get to those hard-to-get-at places in and around car and truck engines, Gulf States Utilities Company's auto shop designed and built a special mechanic's platform. The platform puts the mechanic in the best position to work in the close quarters around engines without straining or mounting an unsafe platform.

Dolly Aids Transformer

Handling and repairing distribution transformers has been made easier in Florida Power & Light Co's shops by the use of a mobile stand or dolly. It cuts down the danger of strains and transformers are less awkward to handle.

The dolly, designed by E. O. Zeigler, is really like a large metal socket on rollers. A transformer can be placed in the socket and easily moved around the shop or shifted in position while it is being repaired.

Only a pilot model of the dolly has been made. An order has been placed for others.



any man can weed-proof 10,000 sq. ft. in ten minutes

with **UREABOR**® This is the weed killer that's setting new standards for big economy with maintenance men from coast to coast. During the past six years, users have proved that, for low cost, safety, effectiveness . . . ease of application . . . UREABOR can't be beat!

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A special spreader is made to apply UREABOR uniformly and fast at low rates. Its low-cost does not reflect the tremendous value of this spreader to any user of UREABOR since it enables a man to weed-proof any area at the rate of a thousand feet per minute! If you have a weed problem, we want you to have the full story about UREABOR weed killer. Write today for details and name of a near-by distributor.

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UNITED STATES BORAX & CHEMICAL CORPORATION, Agricultural Sales Dept., 630 Shatto Place, Los Angeles, California

Ultrasonics Speed Up Cleaning of Demand Meter Registers

SMALL HOME-MADE IMMERSION HEATER brings solution up to temperature for ultrasonic cleaning of meter

EARL R. STIMPSON, Meter Foreman, Pacific Gas & Electric Co, San Francisco, Calif.

With the ultrasonic cleaning methods used at Pacific Gas & Electric Co, a watt-hour meter register that formerly required from 8 to 10 min to clean is now cleaned better in considerably less than 2 min. Demand registers are likewise cleaned better in 2 to 3 min in contrast to the 16 to 20 min required by previous methods.

The cleaning and repair of demand meter registers and timing devices, in general, has long been a problem of considerable magnitude for most utilities. Consequently, many metermen looked with real interest on the possibilities of ultrasonic cleaning methods, which have been used so successfully in the aircraft engine and similar industries.

Action was taken by the San Joaquin Division of PG&E in 1958 when, after much investigation, an ultrasonic generator and one tank were purchased. A few months of experience demonstrated that additional time could be saved if a second tank were available—the generator would permit operation of the two tanks simultaneously.

In this relatively new field there was little experience to draw on and consequently considerable experimentation with regard to the proper type of solutions had to be undertaken.

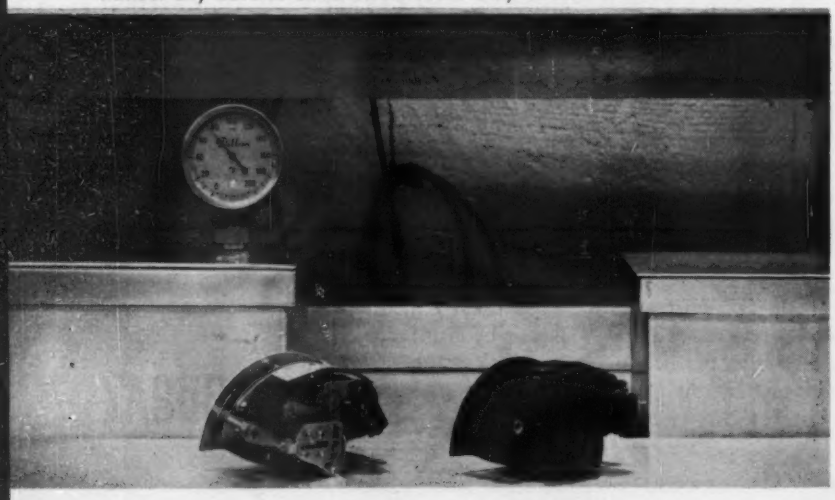
Of all the solutions tried, only three seem to be of real value. The L&R No Foam cleaning solution does an excellent job on any register, however, this solution causes serious reduction in clutch friction on one style of demand register, which necessitates removal of the clutch shaft from the register before cleaning. This operation defeats the purpose of the ultrasonic equipment.

After further experimentation, a solvent called No. 25-I, obtainable from Pioneer Central, a division of Bendix Aviation, proved to be satisfactory. Excellent cleaning of every part of the register resulted and any adverse effect on the clutch was negligible. In using the 25-I solution, it must be heated to about 160 to 170F. This temperature can be maintained by a small home-made immersion heater that provides enough heat input to offset radiation from the tank. After treating the registers in the ultrasonic bath, they are rinsed in hot water and then subjected to a second rinse in trichlorethylene. They are then blown dry with compressed air.

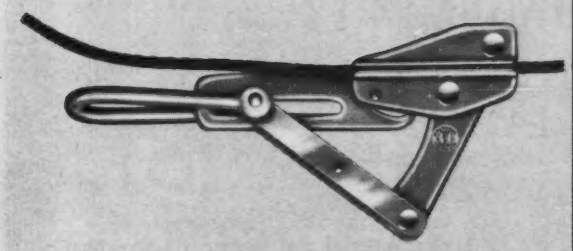
Objects that are soiled with grease or oil can best be cleaned in the L&R No Foam solution, which does not have to be heated. Parts that are soiled with a carbon deposit can be well cleaned in a hot solution of Oakite No. 33. These three solutions, L&R No Foam, Oakite No. 33 and 25-I, provide truly astonishing cleaning results in combination with the ultrasonic bath.

Although the major part of the experimentation has been on the cleaning of combination registers, watt-hour meter registers have been cleaned whenever necessary.

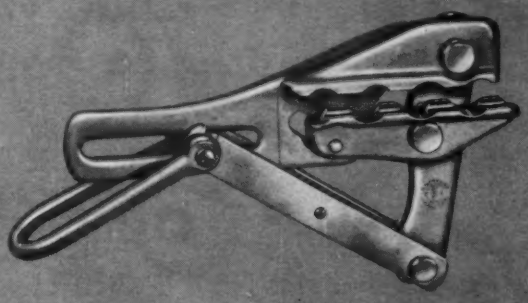
BEFORE AND AFTER VIEW shows the effectiveness of ultrasonic cleaning—without any adverse effect on the meter's dynamics



CIRCLE 44 ON READER SERVICE CARD



1656-40B with bronze-lined jaws. Specially designed for bare A.C.S.R. aluminum and stranded copper cable.
Opening from .50 to .74 inch.

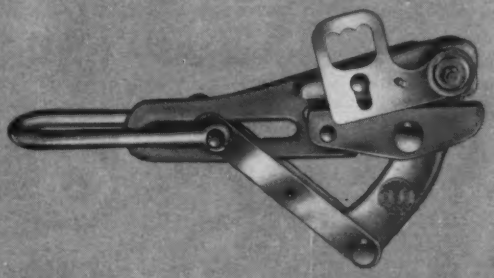


Machined jaws allow snaking insulated conductors, eliminating slippage and preventing conductor damage. Insulation does not have to be stripped from conductor.
1659-40—openings from .49 to .80 inch.

60 DIFFERENT KLEIN GRIPS MEET EVERY UTILITY NEED

If you want a strong, nonslipping grip for use on any type of conductor . . . if you need a pattern specially designed for hot line work . . . consult your Klein Catalog. Klein grips are designed for solid and stranded cable, for messenger guy strand and wire rope, and for weatherproof wire.

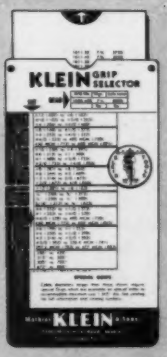
Write for the Klein Grip Selector to make sure you have the proper grip for every job.



This hot line grip may be placed on wire with stick. Safety latch has three positions and closes automatically when stick is removed. Cannot fall off wire. Can be used for hot or dead work.
1628-5BH—openings from .198 to .522 inch.

FREE GRIP SELECTOR

To utility companies, the grip selector is available without charge. It shows the proper Klein grip for any type of wire and gives full information for servicing and maintenance.



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Dielectric Tests Insure Basket-Lineman's Safety

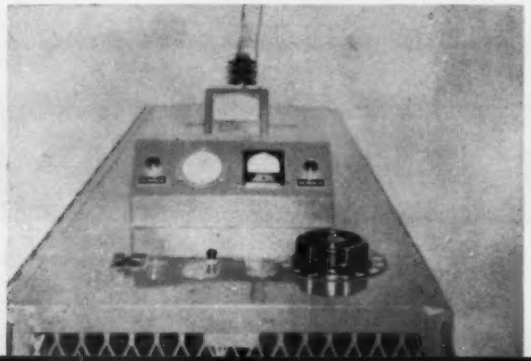
C. CLYDE CROCKETT, Transportation Supt, Louisiana Power & Light Co, New Orleans, La.

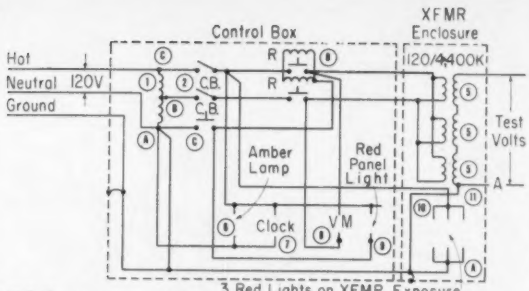
A lightweight, portable, and relatively inexpensive job-fabricated test set is currently safety checking the dielectric strength of aerial baskets at Louisiana Power & Light Co. Furthermore, since the instrument is easily transported to the job site, basket tests are made with a minimum of work interference.

Louisiana Power & Light Co uses aerial baskets for hot line work up to and including 24 kv. Dielectric strength of baskets must be maintained at a safe proper level at all times. To do this, test facilities and techniques were developed for readily determining the dielectric strength of the baskets. Because, in the initial stages of their use for hot line work, little was known of the *continuing* dielectric strength characteristics of Fiberglas reinforced plastic, weekly tests were required on all baskets. These tests were made at 45 kv for 30 sec.

Baskets are prepared for test by cutting soft diaper cloth into pieces large enough to cover one complete side wall of a basket, overlapping the radii at both corners and at the bottom. These cloths are wet with water and plastered to the inside and outside surfaces of the wall section to be tested. All air bubbles are rolled out with a regular wall type paint roller. The "hot" lead from the tester is attached to the inside cloth and the ground lead is connected to the outside cloth. Voltage is applied by a gradual build-up process from 0 to 45 kv for 30 sec. All side walls and the bottom are tested in this manner.

Chief drawback to the tester described here is the limited 3.45-kva capacity. This limitation permits the testing of only one side of a basket at a time; thus, a considerable amount of time is spent making tests. Over a period of two years all baskets were checked once a week. After this two year period the weekly check was extended to two weeks, as per current practice.





ⒶⒷⒸ Variac Terminal Numbers
C.B. ....Magnetic Breaker Set for 30A Instantaneous Trip
R.....SPST 120V 30A Relay
A.....100 MA Ammeter

Tester Material and Pertinent Instructions

Item	Description & Instructions
1	(1)—General Radio Model V20M "Variac," 115-v input, 0-135-v output, 3.45 kva, 60 cycles.
2	(2)—Heinmann No. 0411-CS Magnetic Circuit Breakers, 120 amp, single-pole, complete with trip indication and No. 9-0180-6 handle extensions. Instantaneous trip is required when insulation fails under test. No. 0411-CS breaker has time delay feature which is modified as follows to provide instantaneous trip. a. Movable slug inside trip coil core is locked in maximum "up position" in core. To do this, a hole is drilled in the bottom of the core and the oil is drained. The slug is forced to the top of the core and secured in that position by means of self-tapping screw. This causes instantaneous trip. b. When adjusting breaker for 30-a trip required for this equipment, the trip coil is shunted by a short piece (4 in. to 6 in.) of No. 18 copper. Length of shunt is adjusted until desired operation of breaker is obtained.
3	(1)—Relay, 120 v, 30-a, two-pole, single-throw (shown as 2-s.p.s.t. relays in diagram).
4	(1)—Push button, monentary contact, normally open, 120 v, 2 amp.
5	(3)—General Electric Type JVW-5, 14,400:120-v outdoor instrument potential transformers (Cat. No. 685x59).
6	(1)—Dial Co, Pilot light, 75-w, 125-v socket—use No. 656C, 6 watt, 120-v screw base lamp with amber jewel.
7	(1)—Clock for timing length of application of test voltage.
8	(1)—Triplett Model 430, square, ac, 0-150 v, indicating voltmeter.
9	(1)—Dial Co pilot light, 75-w, 125-v socket—No. 6SC, 6 watt, 120-v screw base lamp with red jewel.
10	(3)—Red lamps located strategically to warn that tester is in use.
11	(1)—Triplett Model 430, square ac, 0-100 milliamp, indicating ammeter.
12	(1)—Kulhman Electric Co primary transformer bushing complete with terminal cap, lead, gasket and hold-down clamp assembly for class OA transformer (13.8 kv).
13	(1)—Pennsylvania Transformer Co secondary bushing with terminal cap and gasket (Pennsylvania Transformer Co, Drwg. No. B65108-B).
14	(1)—Piece plexiglass, ½ x 13 x 13 in.

CIRCLE 45 ON READER SERVICE CARD

NATIONAL BUILDS GIANT COILS FOR STANFORD UNIVERSITY'S MAGNETIC SPECTROMETER

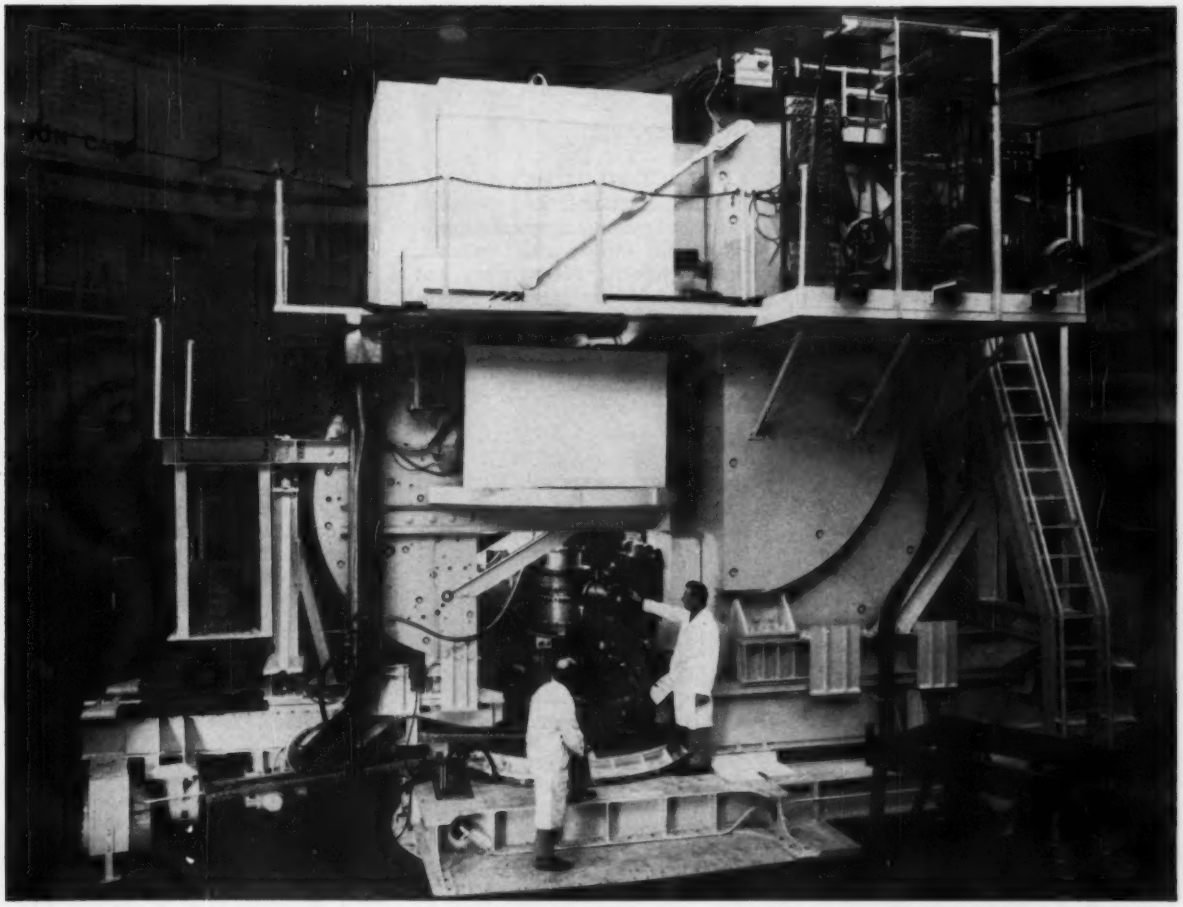
This 72-inch radius spectrometer at Stanford is used for the study of inner structures of atomic particles and particle phenomena.

National built the coils and assembled them into the core of the large semicircular magnet, standing on its point in the right of the photo. The magnet operates at 500-600 volts, 2000 amperes and a field intensity of 18 kilogauss.

A stream of particles is bent 180° around its circumference, slinging heavier particles to the outside by centrifugal force and enabling the number of those of each momentum to be determined.

Working to close tolerances, National built the magnet, using 96 hollow conductors for the main coils, 32 conductors for the auxiliary coils. Hollow conductors permit circulation of the coolant. In the final assembly the insulated conductors were vacuum-impregnated in epoxy resin and cured into a solid mass.

National has unique experience in building electromagnetic components for special requirements. For more information call our Columbus plant... HUdson 8-1151... or the nearest National field engineer.



DIVISION OF

National Electric Coil

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McGRAW EDISON

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CABLE

CABLE MARKER TAGS . . . standard stock shapes and sizes, or customer-made. In light gage aluminum, brass, copper or zinc. Used to identify cable conduits, leads, wires, pipes, hoses. Bulletin 804, two pages. Seton Name Plate Co, 50 Fitch St, New Haven 15, Conn. **(21)**

CABLE SUSPENSION SYSTEM . . . Line-Flex sheathing, a new, "simpler" method of permanently or temporarily suspending heavy electrical cable without need for special equipment, tools or training. Sheathing is available in several diameters in galvaneal or stainless steel. Bulletin 161, four pages. Perfect-Line Mfg Corp, Hicksville, N. Y. **(22)**

POTHEADS . . . Type ST-Sodertite, including aerial lugs and spreader heads, current price list and discount sheet to supersede AA56-P, November, 1956. Bulletin AA-56, eight pages, discount sheet one page. Also, box-mounted oil fuse cutouts. Type BZFC, for indoor and outdoor use, 3-pole, product data sheet, Catalog Section C, two pages. G & W Electric Specialty Co, 3500 W 127 St, Blue Island, Ill. **(23)**

CONTROLS

CONTACTORS AND STARTERS . . . magnetic, size 00, new 100 line. For use on fans, blowers, conveyors and small pump motors for low-hp applications up to 2 hp, 550 v, 3-phase. Construction features illustrated. Modification kit data. Bulletin GEA-7304, four pages. General Electric Co, Schenectady 5, N. Y. **(24)**

CONTROL SYSTEMS . . . combination of electrically and electronically operated devices, designed to produce process variable outputs in accordance with desired or set point conditions. Bailey 720 solid-state electric control systems utilizes such primary measuring elements as thermocouples, strain gages, resistance temperature detectors or movable core transformers. For use in power plants and nuclear plants. Bulletin E74-1, four pages. Baily Meter Co, 1050 Ivanhoe Rd, Cleveland 10, O. **(25)**

CONTROL PILOT DEVICES . . . includes pressure and vacuum switches, pressure governor, plugging and anti-plugging switches, float switches, pilot switches and manual reversing switches. Photos and diagrams. Optional accessories listed for each product. Bulletin, GEA-7302, eight pages. General Electric Co, Schenectady 5, N.Y. **(26)**

PRESSURE SWITCH . . . CR127 and pressure governor, CR127G1. Second catalog supplement sheet for catalog GEC-1260D. Price information, ratings. Also, data on manual reduced voltage starter, CR134, and price changes on other lines. General Purpose Control Catalog Supplement No. 2. General Electric Co, Schenectady 5, N. Y. **(27)**

POWER PLANTS

GAS TURBINE . . . Model 305-S, single-shaft, 9,000 hp, for mechanical and generator drive. Cutaway cross section, plus detailed photographs to highlight design features. Applications discussed. Dimensions and specifications included. Bulletin 186, six pages and fold-in. Clark Bros Co, Olean, N. Y. **(28)**

POOL TRAINING REACTORS . . . in standard designs from 10 to 5,000 thermal kw. Used for education and research. Covers planning, design, operation and training services available to customers. Brochure, GEA-7150, two pages. General Electric Co, Apparatus Sales Div, Schenectady 5, N. Y. **(29)**

CONDENSATE SCAVENGING . . . systems: external regeneration of ion-exchange units. Discussion of history and advantages of internal condensate purification in high pressure central stations. Case histories, comparison of equipment and costs of in-place vs. externally regenerated demineralizers. Technical Reprint T-182, 12 pages. Graver Water Conditioning Co, Sales Promotion Manager, 216 W 14 St, NYC 11. **(30)**

COMMERCIAL GLASSES . . . data on several new glasses, sections on thermal expansion and optical properties. Sections on heat transmission, electrical properties, corrosion resistance, viscosity data, and thermal stress. Charts and graphs. Booklet B-83 (Rev), "Properties of Selected Commercial Glasses," 16 pages. Corning Glass Works, Corning, N. Y. **(31)**

SWITCHGEAR

CIRCUIT BREAKERS . . . new K-Don line, current limiting, low-voltage power circuit breakers and switchgear. Combines 200,000-amp interrupting capacity with complete range of operation of K-Line low-voltage circuit breakers. Equipment dimensions and guide specifications. Bulletin No. 4300-1A, 10 pages. I-T-E Circuit Breaker Co, 1900 Hamilton St, Philadelphia, Pa. **(32)**

(More Literature on page 118)

No more stopping to clear chips

New Irwin Pole-Bor Bits save time . . . money

Now get easier, faster, non-stop boring action in telephone and power poles. Irwin Pole-Bor bits give continuous chip flow—even in creosoted wood. Special Irwin cutting head, twist angle, and smooth-polished hollows eliminate clogging and binding. Side lip smooths hole for easier insertion of bolts and pins. Heat tempering full length gives extra strength, more safety for the man on the pole.

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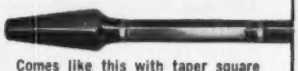
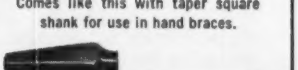
New Irwin Pole-Bor bits come in 12", 18" and 24" lengths, with 8", 12" and 18" twists. Sizes range from 5/16" to 17/16". Use these new Irwin bits for just about any job — whether boring crossarms, small, medium or extra large poles, heavy timbers. And remember: Irwin's patented Adapter Shank fits both hand braces and electric drills. Save time and money. Use fewer bits on the job. Get Irwin Pole-Bor non-stop boring action and extra safety, too. Order from your Irwin distributor today. The Irwin Auger Bit Company, Wilmington, Ohio.

Irwin Adapter Shank fits both hand braces and electric drills



Comes like this with taper square shank for use in hand braces.



Cut off taper square shank. Use in both hand braces and electric drills. No wobble, no run-out.

IRWIN Pole-Bor Bits

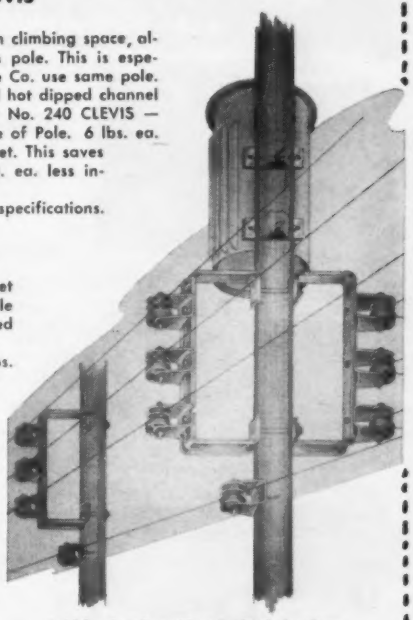
CIRCLE 133 ON READER SERVICE CARD

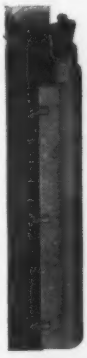
THIEL Secondary Extension Bracket and Insulator Clevis

Moves wire out from Pole to give lineman climbing space, also uses a minimum amount of space on pole. This is especially desired when Power Co. and Phone Co. use same pole. Has 9" wire spacing and only 22" overall hot dipped channel — 2 x 3/16 x 9/16, when used with our No. 240 CLEVIS — center of Porcelain is out 12½" from side of Pole. 6 lbs. ea. Also furnished with Clevis Weld to Bracket. This saves time of bolting out in the field. 13 lbs. ea. less insulators. No. 350.
Extension bracket will be made to your specifications. Mail us your prints for prices.

Secondary Clevis No. 240

For use with Secondary Extension Bracket or Direct Pole mounting 4" center at hole to back of bracket. 3/16" x 3" hot dipped galvanized with or without insulator. Wt. 2¼ lbs. ea., 25 pcs. per case, 61 lbs.





Conduit Guard

For covering Fiber or Transit Conduit or Lead Covered Cable on Terminal Pole. Made of 12 Ga. Steel. Hot Dip Galvanized after Fabrication. Length 9 ft.

Cat No.	Conduit Size	Weight Lbs.
103	3"	36
104	4"	44
105	5"	52½

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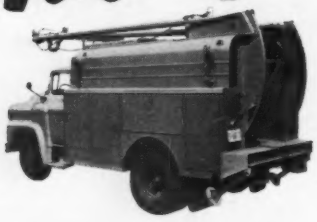

LINE-CONSTRUCTION BODY

. . . available in 9' to 14'6" lengths with mechanical or hydraulic winch and derrick, or any other special or custom equipment desired. Compartments can be arranged to your specifications.

SERVICE BODIES

. . . for ½-, ¾-, and 1-ton chassis. Electrically welded into one unit with six waterproof compartments, recessed paddle handles keyed alike and fender skirt protected with die-formed rolled edges. Built for safe, dependable service . . . will outlast several chassis.

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CIRCLE 136 ON READER SERVICE CARD

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The best in head protection for electrical/construction workers

Jackson's 'Life Guard' safety hats and caps safely resist over 20,000 volts, and they also provide impact resistance to more than satisfy federal requirements for safeguarding construction workers.

'Life Guard' safety caps have narrow brim around sides and back, visor in front. Injection molded plastic is strong yet flexible, has a soft comfortable feel. Caps may be ordered with attached welding helmets, goggles, and assorted face shields.

Standardize on this all-purpose safety hat for maximum head protection. Identify work categories by issuing these different hat colors: white, yellow, grey, and orange.

'Life Guard' safety hats offer neck protection with wide brim all around. The 'Life Guard' headgear is instantly adjustable in hat sizes, and its comfort keeps the hat where it does its job, on the worker's head. Chin straps and warm winterizers are available.

Sold by better welding supply and safety product dealers everywhere

Jackson Products

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More Literature

(Continued from page 116)

INTERRUPTER SWITCH . . . fused, 600-v, Loadmaster 100. Designed to use current-limiting and overload characteristics of dual-element fuses in low-voltage feeders with fault capabilities of up to 100,000 rms symmetrical amp. Bulletin, eight pages. Pennsylvania Transformer Div, McGraw-Edison Co, Canonsburg, Pa. **(33)**

STANDARDS . . . AEIC-EEI-NEMA Standards for Watthour Meters, supersedes 1958 edition. NEMA Pub No. EI 20—1960, 38 pages, $1.35. Dead-Front Distribution Switchboards, Pub No. PB 2—1960, four pages, 20¢. Purchase Specification Data for Gas Turbines, Pub No. SM 31—1960, six pages, 20¢. Gas Turbine Governors, Pub No. SM 32—1960, 14 pages, 30¢. Removable Cable Terminating Boxes for Power Transformers, Pub No. TR 71—1960, 10 pages, 30¢. Integral Cable Terminating Boxes for Power Transformers, Pub No. TR 72—1960, eight pages, 30¢, and Wiring Devices, Pub No. WD 2—1960, eight pages, 30¢. National Electrical Manufacturers Assn, 155 E 44 St, NYC 17. **(34)**

LOAD-CENTER UNIT . . . substations. Operation and applications of new selectively-coordinated units for ac distribution systems, 300 to 3,000 kva, 600 v and below. Types described for any of four basic industrial and commercial power distribution circuits. Bulletin GEA-3592L, 32 pages. General Electric Co, Schenectady 5, N. Y. **(35)**

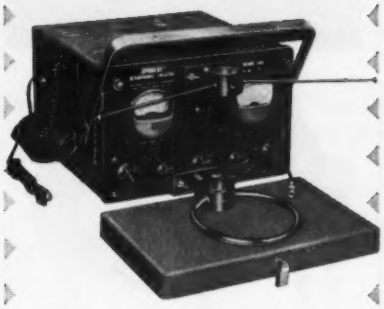
SWITCHBOARD INSTRUMENTS . . . Scale, Type AB-30, 180 deg. Complete line of ac voltmeters (50, 60 cycles) and ammeters (60 cycles), ±1% accurate. Mounting, design and electrical characteristics in accordance with American Standards Assn Specification C39.1. Normal ratings for ammeter models: 5 amp, with other self-contained ratings from 1 to 30 amp. Standard voltmeter ratings: 150, 300, 500, and 600 v. GEZ-3109, four pages. General Electric Co, Schenectady 5, N. Y. **(36)**

(Continued on page 120)

SPRAGUE®

MODEL 500 INTERFERENCE LOCATOR

LOCATE rf NOISE SOURCES QUICKLY



This versatile instrument is a highly sensitive interference locator—*with the widest frequency range of any standard available unit!* Model 500 tunes across the entire standard and FM broadcast, shortwave, and VHF-TV spectrums from 550 kc. to 220 mc. in 6 bands.

It's a compact, portable, rugged, versatile instrument—engineered and designed for most efficient operation *in practical field use.* It features a transistorized power supply, meter indications proportional to carrier strength as well as sensitivity of 5 microvolts minimum for 5% meter deflection over entire tuning range.

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Koenig INTRODUCES A REVOLUTIONARY NEW TYPE OF HEAVY-DUTY POWER WINCH

FEATURING TORQUE TRANSMISSION DIRECT FROM GEAR SPIDER TO DRUM . . . NO KEYS TO SHEAR

20,000 pounds safe hoisting capacity

Outstanding features of the NEW KOENIG WINCH:

★ Drum torque load is NOT transmitted by drum shaft . . . no keys to shear . . . torque is transmitted direct from gear spider to drum by means of multiple-splined collar in gear housing.
★ Entire unit, including safety brake, is lubricated by the oil-bath principle, with a generous supply of oil to prevent overheating.
★ Engineered to use standard lubricants available throughout the world.
★ Multiple-plate automatic safety brake, running in oil with one-direction clutch, is easily adjusted or released.
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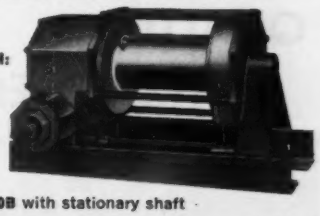
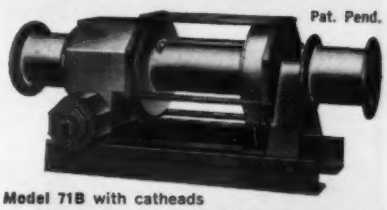
★ Gear ratio — 38:1.
★ Nickel-bronze alloy worm gear. Hardened and ground worm mounted on Timken roller bearings.



Model 70B with stationary shaft

Pat. Pend.



Model 71B with catheads

THIS ADVANCED-DESIGN KOENIG WINCH IS RECOMMENDED FOR OIL-FIELD EQUIPMENT, PUBLIC UTILITIES, HEAVY WRECKERS, CONSTRUCTION, AND OTHER HEAVY-DUTY JOBS.

Koenig winches have served the industry with dependable pull and hoisting power since 1934. Koenig also builds a complete line of utility and service bodies.

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Fits All Standard "S" Type Meters

Made from 16 gauge zinc-coated, rust resistant steel and finished in gray baked-on enamel, the KEES Socket Meter Cover is designed to prevent breakage of glass on socket meters to insure long service in any climate. Outside diam.—8″ and depth—5⅛″ and over. Metal cover is also reported to minimize damage from excessive current surge due to electrical storms.

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Since 1874

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QUALITY TRENCHER?

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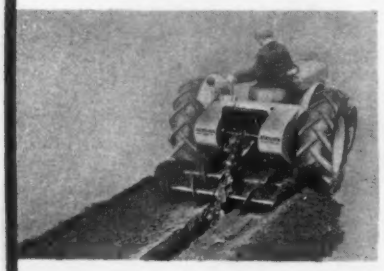
Auburn Machine Works, Inc., established 1928, long known as the "House of Trenchers" is justly proud of its modern, precision equipped manufacturing facilities. Equipment that assures "Quality Controlled" production.

How it's manufactured?
AUBURN's skilled craftsmen have a pride of workmanship that comes with years of experience, training, and study in the manufacturing of trenching equipment. Their expertness in the operation of precision machine tools and their thorough mastery of the measuring and testing devices used throughout each stage of production, is your guarantee of the quality of the AUBURN.



Job proven . . Simple in design the Auburn Trencher is a perfect example of quality and ruggedness. It digs up to 800 ft. per hour—trenches 6" to 14" wide and down to 6 ft. deep.

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More Literature

(Continued from page 118)

TRANSFORMERS

REBUILDING DISTRIBUTION TRANSFORMERS . . . chart on transformer failure probability during long-term load cycle (ten years). Permalex transformer insulation system described (standard on all distribution transformers rebuilt by company's apparatus service shops.) Bulletin, GEA-7108, eight pages. General Electric Co, Schenectady 5, N. Y. **(37)**

TRANSFORMERS & SUBSTATIONS . . . "Quiet Quality" line up to 10,000 kva, and all voltages up to 15 kv. Specification standards, specific information on wide variety of load center and substation models. Data on coil and core construction, insulation, capacity. Substation Brochure, No. 960. Sorgel Electric Co, 838 W National Ave, Milwaukee 4, Wis. **(38)**

PROTECTIVE COATINGS

CORROSION-PREVENTIVE COMPOUNDS . . . Permutit Neutralixing Amines, a group of special organic compounds developed to prevent corrosion of steam and condensate systems through carbonic acid neutralization. Technical Bulletin, CS 111, two pages. Ionac Chemical Co, Birmingham, N.J. **(39)**

OXIDE INHIBITING COMPOUND . . . Contax, for sealing. Leaves no harmful effects on natural or synthetic rubber, improves connection performance. Non-petroleum, synthetic polymer grease with suspended zinc particles. Data Folder No. 6009, four pages. Jasper Blackburn Corp, 1525 Woodson Rd, St. Louis 14, Mo. **(40)**

PROTECTIVE COATINGS . . . nine major Bitumastic products used as cold-applied protective coatings. Specification and properties data. Listing of many typical installations requiring corrosion protection along with recommended Bitumastic coating. Bulletin No. T-97-61, eight pages. Koppers Co, Inc, Tar Products Div, Pittsburgh 19, Pa. **(41)**

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...only Holan-designed derricks can take this punishment

Holan's new 7500 Corner-Mounted Derrick is one of those "in-a-class-by-itself" products.

It has to be to handle the rugged Holan 5400 Earth Borer — the most powerful derrick-suspended digger on the market. It's the only corner-mounted derrick built today that can harness the 8,400 foot-pounds of torque developed by this three-speed digger.

Coupled with the tremendous up and down feed pressures (ranging from 3600 to 5400) of the 7500 Derrick, the 5400 Earth Borer is slashing digging costs every day. That's because it positions quickly, digs up to 30" holes eight feet deep without an auger extension . . . and is powered to "bury its head" in frozen and rocky soil — then spin off at 280 rpm's.

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The Holan 7500 is the only corner-mounted derrick on the market that can handle the 8400 foot-pounds of torque of Holan's 5400 Earth Borer — the most powerful derrick-suspended earth borer built today. The 5400 has three speeds: one for hard digging, one for normal digging, and a fast spin-off speed.

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HOLAN

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Sealed Cable Systems by Simplex Can do so Many Jobs so Well

Simplex C-L-X is a packaged combination of cable and an extremely pliable, corrugated metal sheath. It requires no separate duct or conduit regardless of environment. It is available with steel sheath and plastic jacketing; and with copper or aluminum sheaths, with or without plastic jacketing.

C-L-X Cuts Installation Costs

By using a single length of 3-conductor 15KV C-L-X for both underground and aerial use, a Southeastern utility company saved more than 20,000 dollars from what it would have cost for a complete underground duct system.

Resists Chemical Attack

Conduit life in this company's calcium chloride reclamation building was only 6 to 9 months. The conduit was replaced with a C-L-X cable system which — after two years of operation, shows no signs of deterioration.

Protects Against Liquids and Gases

An East Coast petroleum tank farm used a C-L-X 8-conductor cable protected with PVC for direct burial in ground that was saturated with oil, gas and water. Result: Perfect performance at a sizeable savings over conduit systems.

Only Simplex C-L-X offers you: Exceptional Strength . . . Unequalled Pliability . . . Protection from Liquids and Gases . . . Faster Installation and Lower Costs. Send for Illustrated Brochure containing Application and Engineering Data.

SIMPLEX WIRE & CABLE Co

CAMBRIDGE, MASSACHUSETTS

Hagan Feedwater Controller 'Rides-Out' Generator Trip-out

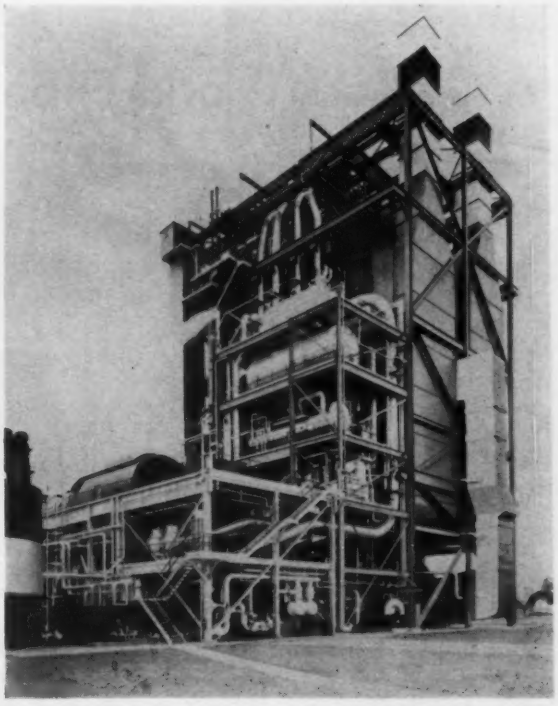
An unexpected generator trip-out recently provided ideal circumstances for an "ultimate" performance evaluation of Hagan Chemicals & Controls, Inc, automatic feedwater control system. Installed at Texas Power & Light Co's Stryker's Creek Station, the three-element feedwater controller was left on "automatic" during an emergency trip-out. Inspection of charts after the difficulty was overcome showed that the feedwater system had maintained proper drum level throughout the two hour shutdown, even though the system went through a complete shutdown, re-start cycle.

Hagan engineers attributed this excellent performance to the fact that the drum level and steam flow meters are compensated, while the system has a unique built-in level monitor circuit. Degree of superheat, rather than total steam temperature, is used as the basis for compensating steam flow measurement—permitting accurate level compensation over a wider range of boiler operation.

Stryker's Creek Station utilizes automatic load control to meet the load swings caused by varying demand. Hagan system installed at the station include automatic combustion control, the automatic feedwater control and all principle metering. The boiler, arranged for natural gas firing, with oil as a standby, is a 1,200,000 lb/hr Babcock & Wilcox unit, operating at 1,875 psi pressure and 1,005F. Recent experience has shown that the Hagan equipment responds with exceptional speed and accuracy to meet all load changes. The good response at the controller is attributed to the circuit arrangement which establishes gas burner differentials and windbox pressures in parallel from the Hagan master sender. Because these two factors move together there is no lag in meeting load changes. Fuel/air ratio measurement is applied to the windbox differential for a final correction.

The Station utilizes outdoor construction. Consequently, much of the Hagan's system equipments are fully exposed to temperatures and moisture changes—this exposure has not affected system performance.

FEEDWATER CONTROLLER was on automatic during a trip-out. Charts afterward showed that the system maintained proper drum level through shutdown and start-up cycle



STRYKER'S CREEK STATION, a 125-Mw outdoor plant, is equipped with Hagan automatic combustion control and three-element feedwater control plus all principal metering

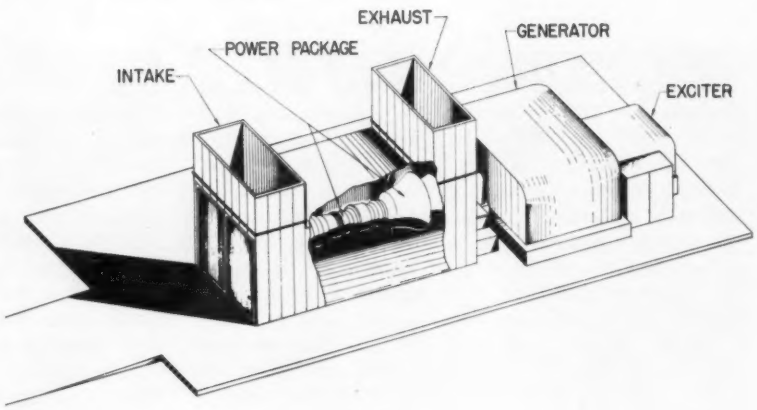
(*More News of Manufacturers on page* 126)

P&WA to Install 'Jet' Generator for Peaking

The nation's first jet engine-powered electrical generator to serve homes and industries will be installed soon in Hartford, Conn., by the Pratt & Whitney Aircraft Div, United Aircraft Corp. A J-57 P&WA engine—the same power plant used to power commercial jet transports and a variety of military aircraft—will be modified to drive a generator through a free turbine wheel. The complete power package will be housed in a small soundproof structure and will provide the Hartford Electric Light Co with the additional electrical energy needed during "peak load" hours.

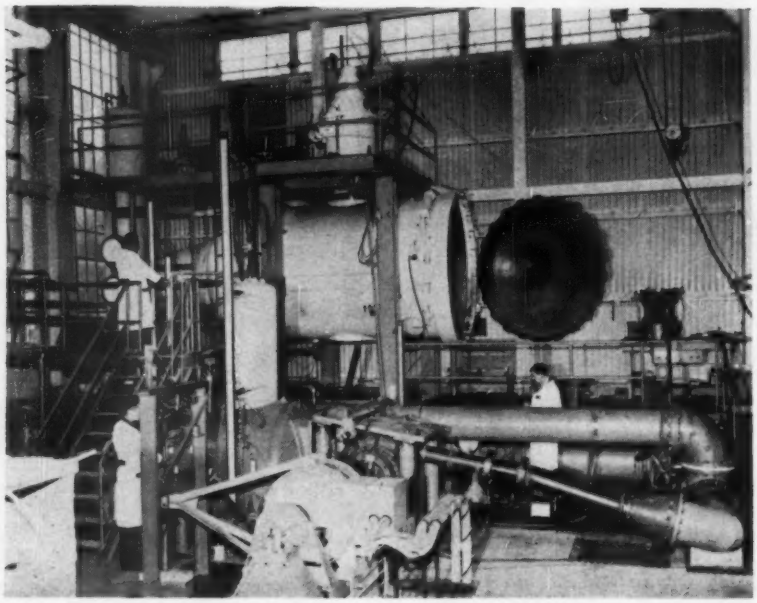
The generating unit, designed by P&WA in cooperation with HELCO, will produce from 8 to 10 Mw. It will be installed in the South Meadows section of Hartford and will be operational by the summer of 1962.

The entire unit will be only about 65 ft long, 10 ft wide, and will have a basic height of 11 ft. It will weigh 25,000 lb.



According to P&WA the lightweight, aircraft-type gas turbine offers several advantages over conventional power-producing units: lower installment and maintenance costs; more adaptability; and, shorter overhaul time—the jet engine can be replaced within six hours. The economics involved in operating the jet-generator for peaking have not been disclosed.

A-C's York Works Expands Hydraulic Laboratory



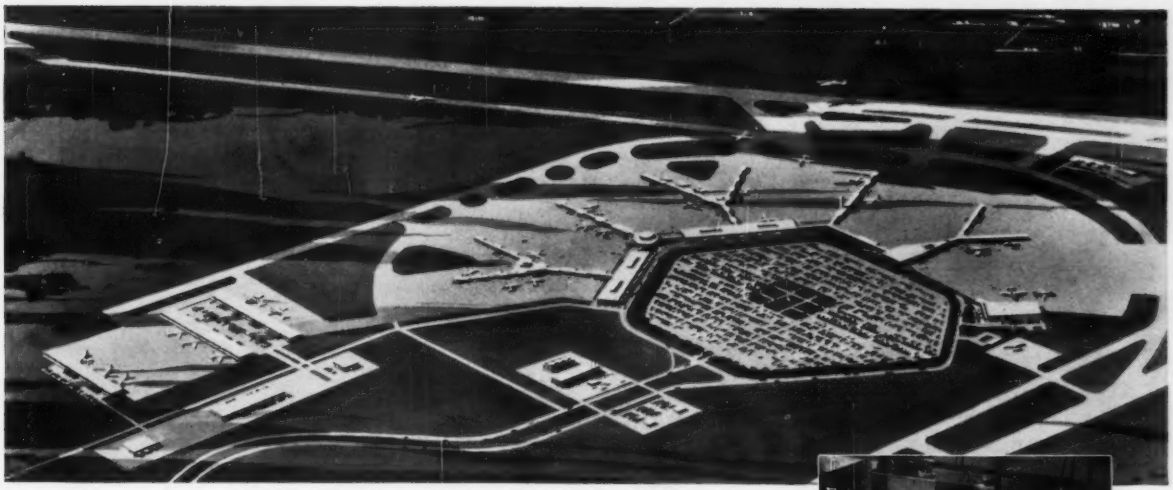
An expanded hydraulic laboratory at Allis-Chalmers Manufacturing Co's York Works, heightens the company's ability to show on short notice the actual performance of any proposed turbine, pump, or pump-turbine unit.

Equipped with eight test stands, three of which are adaptable for pump-turbine testing at 50, 100, and 300-ft capacities, the laboratory permits a wide range of tests.

A 7,000-gal weighing tank, with suitable piping arrangements, makes possible, accurate calibration (in place in its own test circuit) of each flow venturi meter in the laboratory.

In this view of a portion of the laboratory, a runner for a pump-turbine has just been tested in the 300-ft loop, while the model for another unit is being installed in circuit No. 1.

Continuity and Dependability of Electric Power Supply is assured at O'Hare, Chicago's Jet Airport



G&W Switches play a significant role in the 'round-the-clock operations of Chicago's multi-million-dollar O'Hare International Airport. Radio, radar, runway lights, and dozens of electronic devices must never fail or be affected by power interruptions if safety and operational efficiency are to be maintained.

All electrical feeds to these critical areas are in duplicate to assure continuity of power. Vital functions such as control tower equipment and runway lights are switched automatically from any feeder, even temporarily in trouble, to the spare feeder with hardly a blink in the lights.

G&W Automatic Transfer Switches on main incoming service and service to control tower runway lights keep communications and lighting facilities operating to maintain the needed power to guard lives, effect safety, and sustain ten-mile-per-minute jet operations. G&W Manual Switches provide flexibility on other parts of the system.

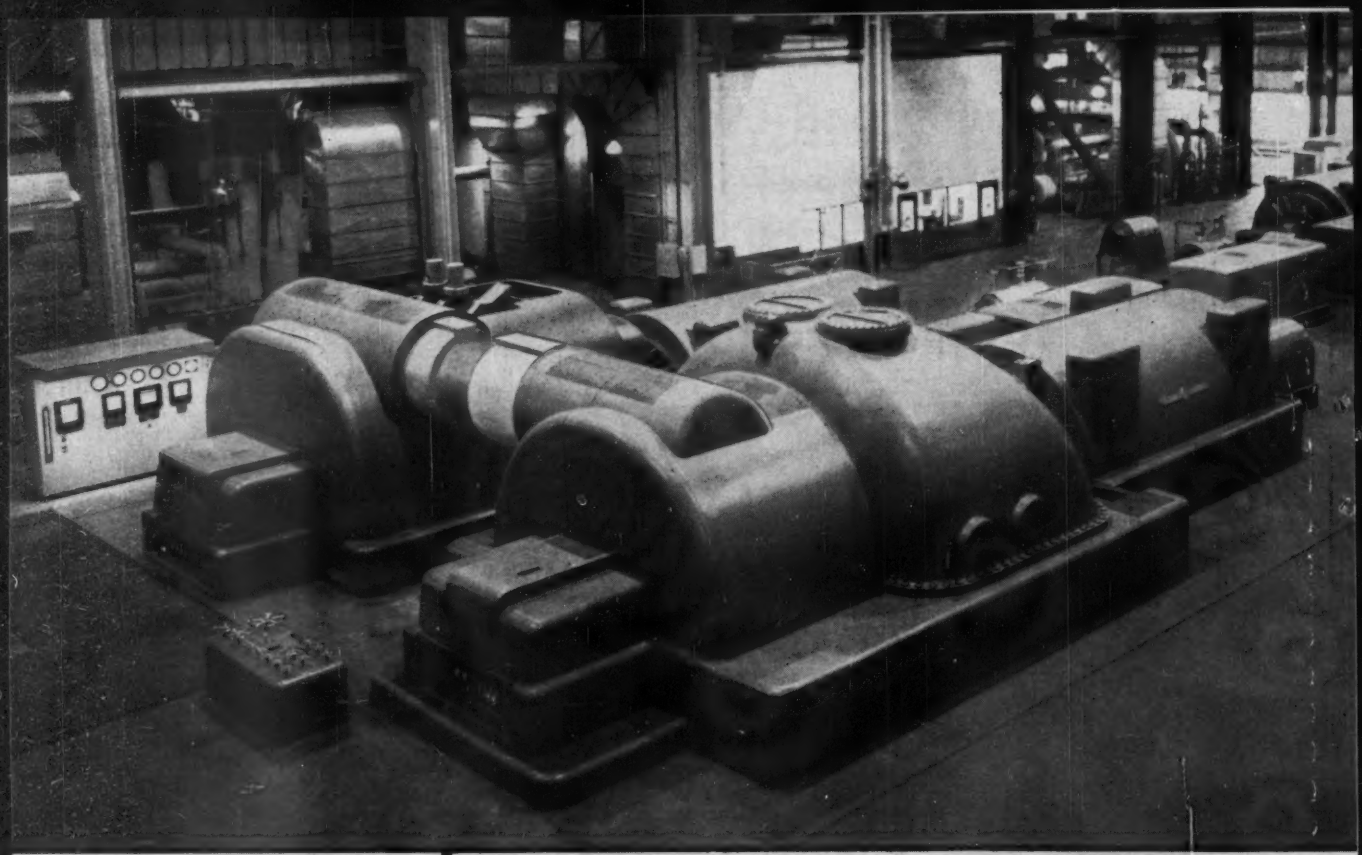
These same measures of switching dependability are inherent to every G&W Switch — records of accomplishment that can be applied to the most rigorous of power requirements. Your G&W Representative is exceptionally well qualified to counsel on every switching need whether standard or specialized in nature. He is at your service without obligation.

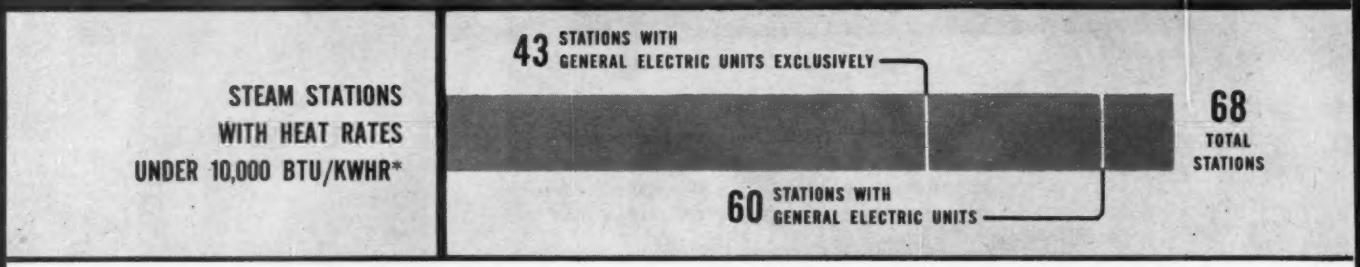
George Lenahan, chief electrician at O'Hare, checks G&W automatic transfer switches, above, on feed to control tower and runway lights, below, on main feed to airport terminal building. Above is artist's concept of how Chicago's jet airport will look in the future.

G&W ELECTRIC SPECIALTY COMPANY
3500 WEST 127TH STREET • BLUE ISLAND, ILLINOIS
Canadian Mfr. • Powerlite Devices, Ltd. • Toronto, Montreal & Vancouver

superior quality standards — inspired specialized design

D61-1





Best heat rate in 1959, 9007 btu/kwhr, was at Potomac Electric Power Company's Dickerson Station, using a General Electric 175,000-kw, cross-compound, 3600/1800-rpm, reheat steam turbine-generator

Best heat rate record: General Electric turbine-generators in 60 of 68 top stations

In 1959, 68 U.S. steam-electric stations had heat rates below 10,000 btu/kwhr*—of these, 60 included General Electric turbine-generators, 43 had G-E units exclusively. Of the 26 stations to reach the goal of 9500 btu/kwhr or better, 23 had G-E units, 17 exclusively.

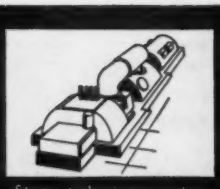
General Electric's record of best stations has been improving annually. So, more and more, installing G-E steam turbine-generators is a major factor in helping you keep power costs low. 244-03

* from FPC report, "Steam-Electric Plant Construction Cost and Annual Production Expenses, 1959."

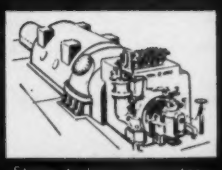
Progress Is Our Most Important Product

GENERAL ELECTRIC

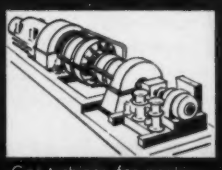
General Electric Turbine-Generators Help Keep Power Costs Low



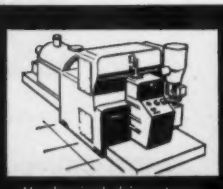
Steam turbine-generators for large blocks of power



Steam turbine-generators 100,000 kw and lower



Gas turbines for peaking, base load, combined cycles



Mechanical drive steam turbines for auxiliaries

Electrical World

FEBRUARY 13, 1961

Management Newsletter

Employees Look Past the Paycheck

Paychecks aren't enough. Or at least that seems to be the feeling in industry. If you want to attract the top grade executive and hold your salaried and hourly workers, you've got to offer something extra. But this doesn't mean ordinary fringe benefits. Paid holidays and group insurance aren't extras any more. They're so common throughout industry that they've lost most of their punch.

Today's extras are the ones that put tangible dollars in men's pockets. For top management, there are stock options and deferred compensation plans. For other members of an industry, stock purchase and savings programs fill the bill.

How extensive are such plans? A study prepared by the National Industrial Conference Board gives a good indication. The Board points out that stock options have been widely accepted in nearly all industries. Of the manufacturing companies surveyed, 70% had an option program. Mining companies were low among the industrial group with 50% giving options. And all this growth has taken place since September, 1950, when clarification of the tax situation involved in a stock option gave these plans a lease on life.

In studying thrift, or savings plans, the Conference Board found 91 in operation among 913 large companies listed on the New York Stock Exchange. These were companies for which necessary information was available, and they represented a fair cross-section of American industries. These figures indicate that about 10% of America's larger corporations have some kind of thrift plan.

Utilities are far from being leaders in this area. While the Conference Board found 60% of America's industries with stock options, only 18% of the electric and gas utilities had them. Furthermore, the study located only four electric utilities which had thrift plans in operation representing about 4.5% of the utilities listed on the New York Stock Exchange. The figure for industry in general was 10%.

A less extensive study just completed by the Union Electric Co seems to support the conclusion that utilities are something less than trail blazers when it comes to the new extras. Union Electric sent out 56 questionnaires. A total of 34 companies responded. Of these companies, only six indicated that they had a stock option, and four acknowledged a savings plan. These results prompt a question. Why are the utilities moving slowly in this area?

No one seems to have a definite answer. But there are many possible reasons. First of all, the utilities' excellent record in employee relations, and the low rate of employee turnover may be working against them when they take proposals for such plans to the regulatory agencies. The agencies could probably argue that the expense of a thrift plan, for instance, was not justified since the utility can find and hold reliable workers without it. Another answer might be that utilities are already offering equivalent inducements to their employees with other programs. Non-contributory pension plans are widely used by the electric companies, and the Union Electric survey showed 16 utilities using stock purchase plans, a program which was not included in the Conference Board studies.

A third possible reason is that utility holding companies have hesitated to ask the Securities & Exchange Commission for permission to use stock options feeling that they were prohibited by the Public Utility Holding Company Act. But a SEC decision last week seems to remove this obstacle (see page 14).

But in spite of all these reasons, consultants who are in constant contact with utility management say that the electric companies are definitely interested in these programs. The interest is relatively recent, probably within the last eight years. But it is growing. One consultant at Commonwealth Services Inc gave the reasons:

Thrift plans and stock purchase plans not only benefit the employee, but they are of great benefit to the company. In some thrift plans, and in all the stock purchase plans, you are helping the employee become a shareholder of the business. If your plan is accompanied by some sort of program to put across the meaning of stock ownership, then the worker comes to realize that in a very real way, this is his company. His reaction is about the same as a man who owns his own car. He takes better care of it than he would of a rented car.

Stock option and deferred compensation plans are extremely important for attracting top quality management. Because of the progressive tax system, it is difficult to compensate an executive according to his value. You reach the point where even a slight increase in his take-home pay represents a large expense to the company. Stock options are a method for giving the executive an increase under a more favorable tax situation.

Which will prove more significant in the future? The "why's" or the "why not's"? Will the utilities use more of these programs, or will they continue to move slowly? At Commonwealth Services the opinion is that they will use more of the plans. One consultant puts it this way. Regardless of whether it's the regulatory agencies, or the companies themselves that have slowed the movement toward such plans there will probably be some changes. The competition for people with top managerial skill and for skilled workers is getting more intense all the time. The health of the industry demands that the utilities get their fair share of this talent. There are many specific situations in which such incentives are not the answer. But for a number, these plans are coming more and more into the picture.

Union Electric Co's survey compiled an impressive list of the types of plans already in use among utilities. No two are completely alike. Apparently each one is molded to fit the company that uses it. But particular features of the plans show some consistency. Here is how they shape up.

Stock option and deferred compensation plans are, in general, aimed at the top level of management. Both are children of the present tax legislation. The stock option gives the executive the opportunity to realize a profit on the appreciation of the company's stock under the theory that such appreciation is due in no small measure to his efforts. Since it is taxable at the lower capital gains rate, this profit means more to the executive than the equivalent increase in salary. Also, he pays no tax at all on the profit until he has sold his stock, a time in which he is in a good position to pay the tab.

Of the six stock option plans reported in the Union Electric survey, five are limited to officers of the company and key employees as designated by the board. The option price in four of the companies is 95% of the market price on the day of the grant. One company uses the market price. All these plans specify a time requirement before the option may be exercised, usually two years, with one company allowing a percentage to be exercised each year with at least four years required before the entire option may be taken. While these waiting periods are primarily designed to discourage the use of the option as a speculative device, they have an important by-product for the company. They tend to make top executives deaf to offers from outsiders. The executive knows that he has the increased value of the stock waiting for him at the end of the period, and this makes him less willing to leave the company.

But a different philosophy runs through the sixth option plan. This plan is open to virtually all supervisory employees, with the option price set at market less discounts ranging all the way up to 15% depending on the length of service. The employee pays 5% of the option price in cash, and the balance in payroll deductions over a ten-year period. Furthermore, after four years have passed, the employee can exercise the option to the full extent of his down payment plus his payroll deductions. This plan incorporates many of the features of an employee savings plan. Obviously, it is designed not only to reward key executives, but also to extend the benefit of the increase in stock value to virtually every supervisor in the company. Such an arrangement seems loaded with incentive.

Deferred compensation plans, in effect, increase the executive salary. But instead of paying this increase while the executive is working, and presumably in a high tax bracket, the increase is spread through the years following his retirement when his tax base will be a good deal lower. In return for this continued salary after retirement, the executive agrees to perform consulting duties for the firm. Naturally, only people of outstanding quality are of value in a consultant's capacity. So, deferred payment plans are used only for top executives.

Of the plans aimed at universal employee participation reported to Union Electric, the stock purchase plan is apparently the most common among the utilities. The plan offers employees at virtually every level a simple method of saving by means of investment in company stock. All of the 16 plans in the Union Electric survey put limits on the amount the worker may invest in this plan. Most of the companies specified a maximum percentage of salary, but two preferred to put the limit on the number of shares for which he might subscribe. By and large, the employee was buying the company's common stock from a special issue set aside for this purpose. Only five of the companies made purchases in the open market, and only one had a plan for preferred stock. Discounts on the stock price ranging from 10 to 28% were offered by about half the companies.

The expenses incurred by the company in these plans varied. But generally they were contributing brokerage fees, any discounts on the purchase price, interest on

bank loans, and associated insurance fees. The usual procedure was to have the employee receive each share of stock as he paid for it. But in other cases the employee received the full number of shares in the subscription only when the subscription was completely paid. When companies used this method, dividends accruing were credited to the employees account.

Aside from the advantages to the worker of developing a systematic savings program at lower cost than he could obtain by himself, there's a considerable benefit to the company that may well offset the cost involved. With such a plan, each worker becomes a stockholder, an owner of the company he's working for. And with ownership goes responsibility. The worker comes to treat the company as his own with concrete results showing up on the profit and loss statement.

The thrift plan, also called employee savings, is another plan aimed at universal participation. In the four thrift plans reported in the survey, all employees are eligible, but there is some form of time restriction. This is either one or two years of continuous employment, and is probably used to reduce the paper work that would be involved if the plan were open to employees who leave within a few months. In each case, employee's participation is limited according to salary.

But the company makes a contribution in addition to the worker's payment. Of the companies answering in the survey, three contribute 50% of the employees amount. The fourth company puts up one-third. This money is then invested in either company stock or government bonds, the choice being up to the employee. Two of the plans specify that the company contribution shall be used for company stock and give the worker a choice only on his portion. In one case, the worker is allowed to withdraw the total value of his savings every five years. The other plans allow the employee to withdraw his own contribution at any time but do not allow him to withdraw the company's contribution until the end of the period.

In these plans, the expense to the company is quite obvious. But so are the advantages. For one thing, those workers who elect company stock have the same interest in the company as they would have under a stock purchase plan. But even those who elect to buy government bonds can see their savings growing more rapidly than they would outside the company. This helps employees to see the company as a career; not just a place to work, but also a source of lifelong security.

It is frequently argued that the company would do well to pass this money along simply in higher wages. The employee is much more conscious of what's in his pay envelope than he is of money that is off in the future. And there's no better way to build good worker relations than to raise the salaries.

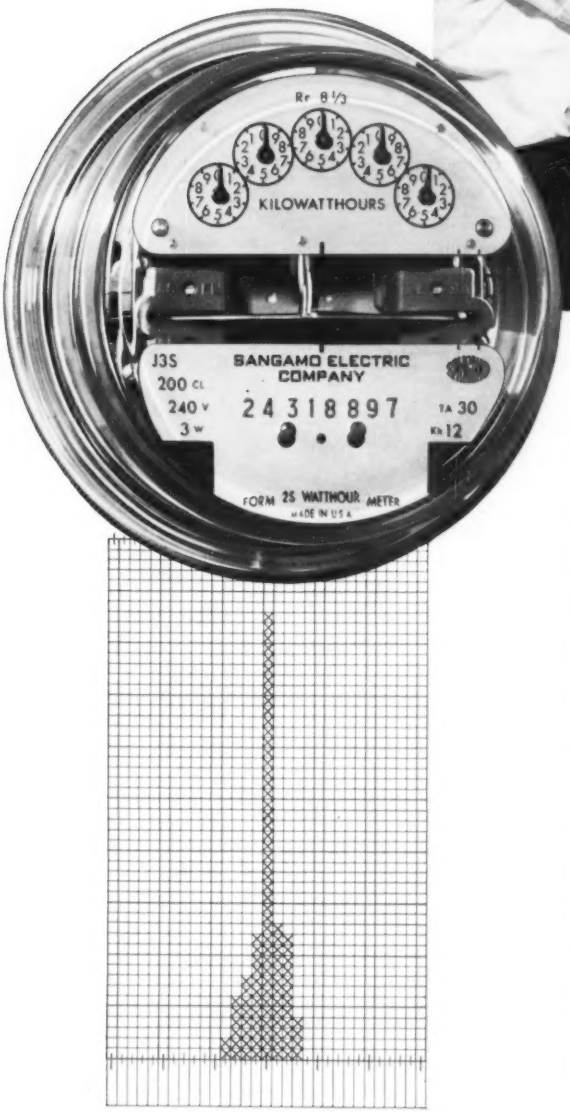
Taking a very short-run viewpoint, this is true. But a salary increase is popular only until the company next door raises its salary. Then the employee wants to regain his old position of superiority to the neighboring workman, and when he finds that the company is not ready to grant another increase, the firm's popularity rapidly dwindles.

If, on the other hand, the worker owns shares in the company, or if his savings are soaring under company sponsorship, then he's less apt to be affected by a salary increase for the worker next door. The company's value to him is viewed on a long term basis, not just from week to week.

If these plans for "extra compensation" continue to grow throughout industry, then utilities too may move rapidly in this direction. For the growth of such plans would be indicative of the fact that they are popular with all classes of workers. Then both the companies and the regulatory agencies would be faced with the fact that the second best plan for compensation attracts the second best grade of people.

true MAGNETIC flotation

J3 THE METER BUILT FOR SAMPLE TESTING



Utility meter departments employing sample acceptance and service tests can depend upon the good $\bar{x}$ and σ results of Sangamo's new J3 to assist in reducing operating costs.

tremendous teammates

Sangamo J3 meters and sample testing are tremendous teammates. The J3 was designed with sample testing in mind... Its original accuracy and dependability will remain constant for many, many years. This goal was achieved by combining J3 True Magnetic Flotation with highest torque, slowest speed, high surge resistance, and a balanced moving system to give calibration stability.

Successful acceptance and service sample testing programs require the high sustained accuracy and long term service dependability inherent in Sangamo's new J3 meter.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

JM60-10

THEY DO THE JOB BETTER WITH THE RIGHT WORKING GEAR

Mine Safety Appliances Company makes the "right" working gear. *Right* because it keeps crews safe. *Right* because it's comfortable to wear. *Right* because it's convenient to use. And *right* because it lasts and lasts a long, long time.

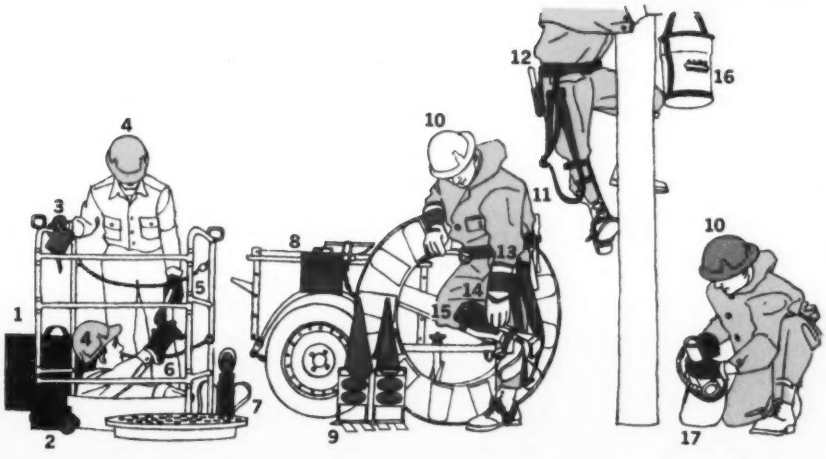
The men in the above situation are demonstrating a typical cross-section of our product line for electric utilities, from manhole to pole top. We control quality and specifications of each and every item . . . *at MSA.*

Our products protect sensitive noggins. Sniff out atmospheric hazards. Help anchor the climber's swift sure feet. They insulate his hands against the hot stuff. Keep him dry in foulest weather. Secure his waist while high above the ground. Carry things to him he can't carry with him. Warn oncoming motorists.

Some of our products only sit and wait. Products like First Aid. Resuscitation devices. Emergency rescue equipment.

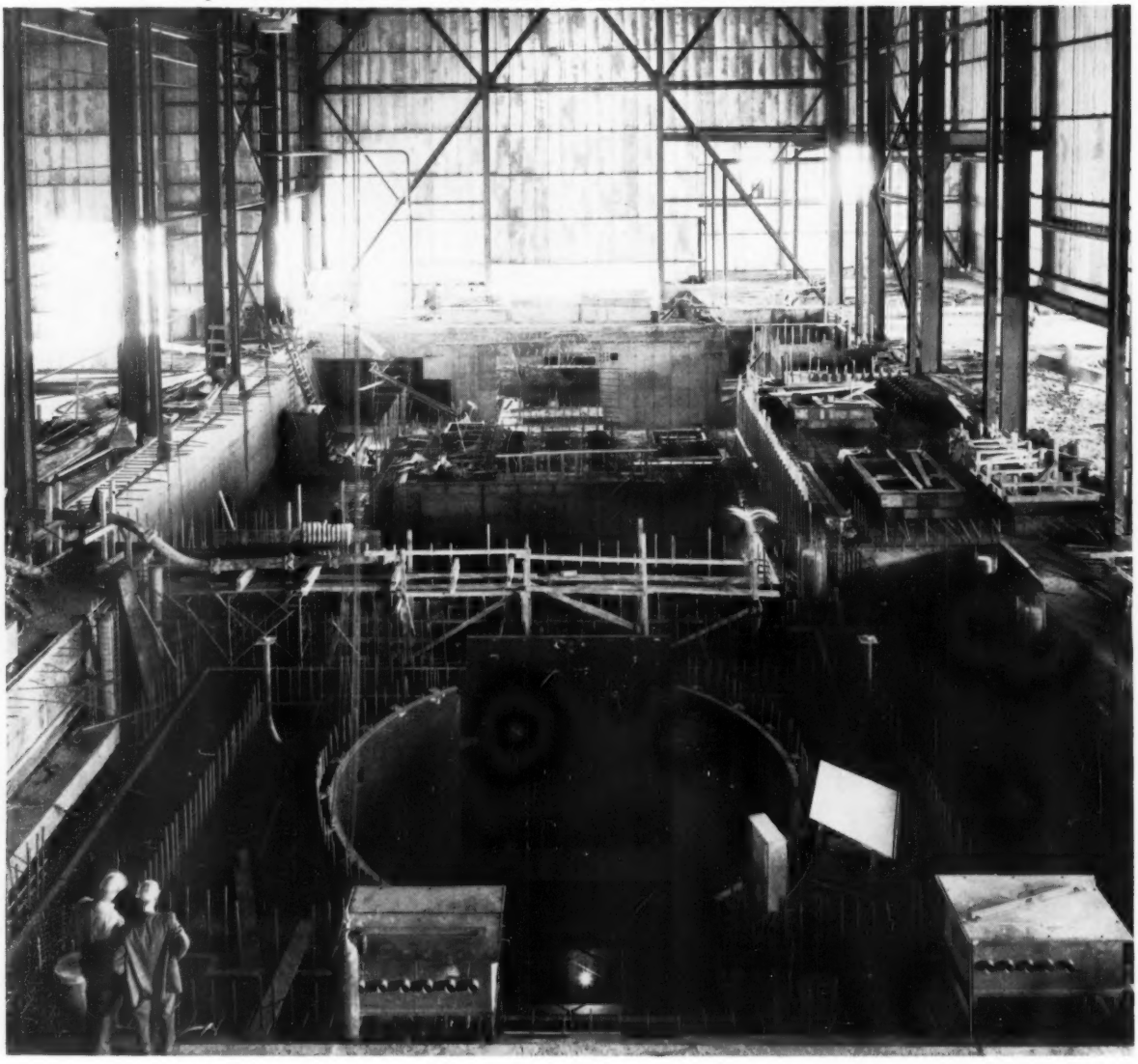
We'd like you to weigh the comparative advantages of MSA's product performance. For a demonstration, technical assistance or specific product bulletins, write: Mine Safety Appliances Company, Pittsburgh 8, Pennsylvania.

MSA **MINE SAFETY APPLIANCES COMPANY**



Legend for MSA Product Identification: **1.** Air Line Respirator. **2.** Oxygen Indicator. **3.** Explosimeter Instrument. **4.** Shockgard Caps. **5.** CO Tester. **6.** Work Gloves. **7.** H_2S Detector. **8.** First Aid Kit. **9.** Road Markers. **10.** Shockgard Hats. **11.** Coated Rainwear. **12.** Lineman's Belt and Pole Strap. **13.** Lineman's Rubber Gloves. **14.** Leather Protector Gloves. **15.** Brooks Climbers. **16.** Tool Bucket. **17.** Line Hose Bag.

75,000 KW Sodium Graphite Reactor station for Consumers Public Power District at Hallam, Nebraska



The Peaceful Atom

Helping the world double its power supply in the next ten years

The fuel of the future is in the atom. But even now, lights are burning, wheels are turning, thanks to atomic fuel. Atomics International, a world-wide leader in advanced, high-performance reactor systems, has over 15 years' experience in designing, constructing, and operating reactors. Two of the world's most advanced atomic power stations are now being built by AI under AEC programs. The wealth of experience and facilities at Atomics International will help the world's power-producing companies in their plans to double the supply of electricity in the next ten years.

ATOMICS INTERNATIONAL

Division of North American Aviation

Pioneers in the creative use of the atom

World Headquarters: Canoga Park, California, U.S.A. Cable Address: ATOMICS. *Other offices:* Washington, D.C., U.S.A.; Geneva, Switzerland. *Affiliated with:* INTERATOM, Bensberg/Cologne, Federal Republic of Germany and DYNATOM, Paris, France

CILCo Elects Feltenstein Vice President

HARRY D. FELTENSTEIN JR ▶

Harry D. Feltenstein Jr has been appointed vice president of Central Illinois Light Co.

He has been with CILCo since 1941, when he joined as a groundman in the company's Springfield electric department. He was transferred to the gas heating department in 1946. Two years later he became Peoria sales engineer, and, in 1952, was named Pekin service sales supervisor.

In 1954, Feltenstein became director of CILCo's area development activities and public relations director. In 1955 he was promoted to Peoria division sales manager, and became service sales director in 1956.

Shawinigan Water & Power Appoints Three Vice Presidents

SMITH BOUCHARD KING

Shawinigan Water & Power Co has named Joslyn A. Smith vice president-production and power operations; Jules Bouchard, vice president-distribution; and Donald King, vice president in charge of the system planning and engineering department.

Smith and Bouchard were formerly assistant vice presidents, and King was assistant manager, power operations and engineering department.

MacCarthy Named Manager of General Electric's Project EHV

Donnell D. MacCarthy (left in photo) has been appointed manager of General Electric Co's Project EHV (Extra-High-Voltage), Pittsfield, Mass. He succeeds Dr Pier A. Abetti (right) who has been promoted to manager of the company's Electrical Engineering Laboratory, Schenectady.

MacCarthy will direct the completion of the $7.5-million prototype system which is studying the transmission of electricity at super voltages.

He has worked on Project EHV since last May as manager of system engineering of the power transformer department. Earlier he was manager of engineering for voltage regulator products and section engineer in charge of lightning arrester development.

MacCarthy taught electrical engineering at Cornell University for four years before joining GE in 1930.

(*More News About People on page* 140)

ANACONDA®
designs and makes both
ACCESSORIES
and EHV cable

The same engineering teams research, develop and use-test both EHV accessories and cable at Anaconda. The advantage is clear: no weak links in the system.

This coordinated effort has another customer benefit —special accessory problems can be considered when the system is designed. For example:

One customer needed a semi-stop joint that would not only locate faults and isolate any pressure loss in HPOF pipe-type cable, but would also let the cable move longitudinally without disrupting the seal or crushing the insulation. Anaconda met both requirements with a flexible barrier design that also matched cable characteristics perfectly.

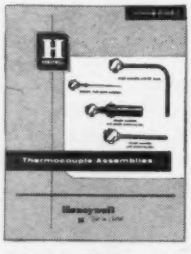
In another typical case, a customer desired a preassembled termination unit that would provide controlled bending and fast sealing of pipe-type cable during the difficult pull to the first manhole. Furthermore, the customer's operating requirements would allow no welding either during or after the pull. Anaconda answered the problem with a "drop-casing" terminal assembly that proved to be a unique solution.

These examples won't necessarily parallel your own requirements, but they do demonstrate Anaconda's capacity to develop specialized accessories that meet the requirements of the customer and the cable equally well. To find out specifically how Anaconda's Integrated Approach can solve your EHV accessory problem, contact Anaconda Wire and Cable Co., 25 Broadway, New York 4, New York. 60227

See the man from
ANACONDA®
for accessories

THERMOCOUPLE ASSEMBLIES

More than 100 complete T/C assemblies, available in a range wide enough to cover most applications in any industry, under any environmental conditions. Included are straight, angle, high-speed, high-temperature and spring-loaded assemblies. They are among many thousands of accessories—all available from a single dependable source—to help your instruments perform at their best.



Get details from your Honeywell field engineer, or write today for Catalog G100-1.

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Honeywell

First in Control SINCE 1906

PERSONAL BRIEFS

Puget Sound Power & Light Co has named **Kenneth A. Kraft** advertising supervisor. **Will Teller,** Puget Sound Power & Light's chief personnel representative, has been elected president of the Seattle chapter of Pacific Northwest Personnel Management Assn.

At Detroit Edison Co, **Paul A. Duker** has succeeded the late **George M. Allen** as industrial sales director; **Robert H. Dowen** became senior industrial sales engineer; **M. William Heidman,** supervisor of municipal sales; **J. Douglas Elliott,** assistant to the general accountant; **Albert J. Gebauer,** director of central data processing; and **Frank Kehoe,** assistant to the tax department director.

Baltimore Gas & Electric Co has appointed **Joseph H. Purdy** public relations director. **Newell M. Calloway** was named customer relations manager.

In Arkansas Power & Light Co's general office engineering department, **William M. Brewer** has been promoted to long range planning section head; **Samuel B. Nickelson** to relay and communications section head; and **W. E. Shaffer** to the long range planning section to handle transmission planning. Also, **E. E. Thompson** and **Billy E. Green** transferred to the long range planning section to handle distribution planning; **J. E. Brabston Jr** to the relay and communications section to be assistant to the section head; and, in the R&C section, **Reb M. Scoggins Jr** took charge of relay and **J. W. Beason,** communications.

Electric Autolite Co Vice President **Lawrence L. Garber** has become group executive, directing the operations of three divisions: automotive and aircraft batteries in the US and Canada, industrial batteries, and wire and cable.

Motorola Inc has named **Robert H. Davis** chief engineer of the microwave department.

Ralph Zeuthen, former manager of EEI's Live Better Electrically program, has joined Compton Advertising, Inc. He will be vice president and account supervisor.

About that property of yours...

PAGE FENCE

These 3 VALUES are important

1. QUALITY is important. When you invest in a fence you want it to last for a long, long time. When you specify PAGE you get 77 years of our experience in the design and manufacture of a quality fence. Page Fence is engineered for long-lasting service and is covered by a Registered Certificate of Quality.

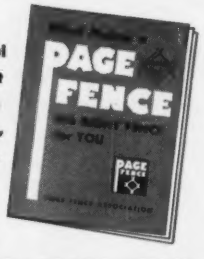
2. WIDE CHOICE is important. For example, we offer a choice of 4 chain link fabrics—ACCO-Aluminized, our latest development, or galvanized steel, stainless, or solid aluminum. Each of these has characteristics which meet individual preferences or make it more suitable to meet certain climatic or service conditions. Furthermore, there are 8 basic fence designs and 6 gate styles. No other company can serve you with so wide a selection.

3. INSTALLATION is important, too. A fence can be no better than the quality of its erection. The Page Fence Member in your locality is trained, experienced, responsible, and interested in your satisfaction.

• • •

When you write us, we'll send you the whole story in a helpful booklet, and the name of our nearest Member. Call him, he will gladly suggest the best answer to your property protection problem.

Helpful booklet describes fence styles, gates and, components



PAGE FENCE ASSOCIATION
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...AND YOU DON'T HAVE TO CHANGE YOUR FIXTURES!

NEW WESTINGHOUSE HIGH EFFICIENCY LAMPS GIVE YOU 1/3 MORE LIGHT AT NO EXTRA COST!

YOU'RE LIGHT YEARS AHEAD WITH WESTINGHOUSE . . . and the brightest, most economical 40 watt, 90 watt, and Slimline fluorescent lamps on sale anywhere! These new lamps give you an entirely new kind of light . . . a Westinghouse exclusive resulting from a special blend of yellow-green and color improving phosphors for better see-ability.

Now you can increase the lighting level in your factory, office, or warehouse without changing a single fixture—without adding a cent to power costs—and without paying premium lamp prices.

New Westinghouse High Efficiency "H.E." lamps (40 watt Universal, 90 watt and 96" Slimline types) give 15% more light than cool white lamps—a full third more light than daylight lamps. You get more lumens per watt (3200 lumens/40 watt lamps and 6400 lumens/90 watt and 96" Slimline lamps), and this extra light output costs you no more than less efficient lamps.

Take advantage of the Westinghouse Lighting Cost Reduction Plan and cut costs by one or more of the following factors:

1. **Reduced cost of lamp purchases!**
2. **Reduced lamp replacement labor costs!**
3. **Increased lighting level for the same or lower costs!**
4. **More efficient use of power!**

Try the new Westinghouse "H.E." lamps in an entire work area. If you don't agree that you get more light—softer, more comfortable light—we will gladly exchange them for any other Westinghouse Fluorescent Lamp of your choice. Order "H.E." lamps today and get more information on the Lighting Cost Reduction Plan from your authorized Westinghouse Lamp Agent or your nearest Westinghouse Lamp Sales Office! *You can be sure... if it's Westinghouse.*

Westinghouse

Westinghouse Lamp Division, Westinghouse Electric Corporation, Bloomfield, New Jersey

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CONSTRUCTION · PLANS · SURVEY · REPORTS

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$1.80 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.80 a line an insertion.
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DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

Send New Advertisements to Classified Advertising Div. of Electrical World, P. O. Box 12, N. Y. 36, N. Y.

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NEW YORK 36: P. O. Box 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 11: 255 California St.

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Electrical Engineer familiar with electric power systems. Permanent employment with oppotunity for advancement in long-established consulting engineering firm. Write or call Stanley Engineering Company, Muscatine, Iowa.

Construction Supervision. Construction Engineer for inspection and supervisory work on electric power lines and substations. Opportunity for permanent employment and advancement with well-known consulting engineering firm. Send resume to P-6001, Electrical World.

Communications Engineer: Graduate Electrical Engineer with minimum of three years experience in microwave, carrier and two-way radio systems. Position located in San Bernardino in Southern California close to the beaches, mountains and desert resorts. If interested in expanding company with excellent future possibilities, submit complete resume of education, experience and salary requirements to the Personnel Department, California Electric Power Company, P.O. Box 1029, San Bernardino, California.

POSITION WANTED

Electrical Construction Engineer, 15 years experience as superintendent for construction of oil refineries, steam power plants, gas turbine power plants, industrial plants etc. Desire similar job, domestic or overseas. PW-5975, Electrical World.

SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFG	VOLTAGE
1	12000	G. E.	115,000—46,000 L. T. C.
1	5000	West.	115,000—13,750, 3 Ph.
1	10000	West.	67,000—34,500, 3 Ph. Auto.
1	3750	G. E.	69,300—13,200, 3 Ph.
1	3000	G. E.	69,000—4340, 3 Ph.
4	2000	Amer.	67,650—22,000
6	1667	West.	66,000—2300/4000
3	1250	G. E.	69,300—2400/4160
6	750	Wagner	66,000Y—13,200
4	333	West.	67,000—7200/12470Y
2	2500	Wagner	45,000—4160Y, 3 Ph.
3	333	G. E.	44,000—480
1	5000	West.	34,500—13750/6875, 3 Ph.
1	4500	West.	33,000—2500/4330, 3 Ph.
2	3000	Upgf.	34,750—4160, 3 Ph.
2	1500	G. E.	34,400—2520, 3 Ph.
3	1250	A. C.	33,000—480
4	750	Wagner	33,000Y—6900
3	500	Mol.	34,500—2300/4600
3	200	A. C.	34,500—2400/7200/12470Y
2	3000	G. E.	26,400—4160Y/2400, 3 Ph.
2	3000	G. E.	13,800—2640, 3 Ph.
1	2500	G. E.	13,800—2400, Unit Sub.
3	667	G. E.	13,200—240/480
1	600	Stand.	13,200—2300, 3 Ph.
1	450	Penna.	13,200—2400, 3 Ph. Askarel
3	100	A. C.	6,900—2400
1	1000	A. C.	2,400/4,160—240, 3 Ph.
3	400	G. E.	2,300/4,000—230/460

FREQUENCY CHANGERS

1	4600 Kw, 60 cycle, 13800 volts, Generator 6500 Hp, 25 cycle, 11000 volts, Motor—300 Rpm
1	1500 Kw, 60 cycle, 2300 volts, Generator 2100 Hp, 25 cycle, 2300 volts, Motor—300 Rpm
2	1000 Kw, 60 cycle, 2300 volts, Generator 1580 Hp, 25 cycle, 2300 volts, Motor—300 Rpm

Also: FEEDER REGULATORS, M-G SETS, SWITCHGEAR and CIRCUIT BREAKERS, etc.

BREW, WOLTMAN
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52 Church Street, New York 7, N. Y.

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3—2500 KVA G-E 69000—2400/4160Y
3—2500 KVA G-E 69000—7200/12470Y
4—2500 KVA W-H 34500—2400/4800
3—1500 KVA G-E 69000—2400/4160Y
3—1500 KVA G-E 69000—7200/12470Y
4—1000 KVA Mol 7200/12470Y—4160
3—1000 KVA G-E 34500-7200/12470Y
6— 500 KVA G-E 34500-2400/4160Y
3— 833 KVA W-H 43800—480
3— 333 KVA W-H 13200—2400/4160Y
3— 333 KVA GE 66000—2400/4160Y
3— 333 KVA Wag. 2400—120/240
2—1500/1875 KVA Mol. 3-Ph. 40,500—4800 F/C equipped
2—1500/1875 KVA Mol. 3-Ph. 34,500—2400 F/C equipped
2—1500/1875 KVA Mol. 3-Ph. 43800—2400/4160 F/C equipped

TRANSFORMERS WANTED

THE ELECTRIC SERVICE CO.
5316 Hetzel St.
Cincinnati 27, Ohio
47 Years' Dependable Service

U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-5496) will be received at Denver, Colorado, until 2 p.m., Mountain Standard Time, March 7, 1961, for furnishing nine (9) 230-kv, 1,600-ampere, 10,000,000-kva, dead-tank oil type only, power circuit breakers for Keswick Switchyard, Central Valley Project, California. Delivery is desired within 360 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 25, Colorado. Floyd E. Dominy, Commissioner.

Federal #14622 switch, 60 amp, double throw, pole $10.00.
Jefferson #234-886-200 fluorescent ballast 50-50-10 off list.
G.E. #319 aviation lamp .30¢ each.

SOLVAY TRADING CO.
500 Scarboro Rd., Syracuse 4, N. Y.

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ELECTRICAL WORLD
330 W. 42nd St., N. Y. 36, N. Y.

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BOX NUMBER

When answering the classified advertisements in this magazine don't forget to put the box number on your envelope. It's our only means of identifying the advertisement you are answering.

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International Organization wishes to help highly qualified Engineer who must relocate through no fault of his own. At age 50 has 9 years experience in Electrical Transmission and Distribution, 3 as Superintendent; 13 years Superintendent of Operations, and 6 years management advisory experience on Operation, Construction and Maintenance.

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Send for new list to
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Meetings Calendar

FEBRUARY

Upper Midwest Electrical Industry Convention—Leamington Hotel, Minneapolis, Feb. 19-22.

National Wiring Bureau Sales Conference—17th Annual Meeting, Sherman Hotel, Chicago, Feb. 23-24.

MARCH

• **7th Annual Public Utilities Seminar, American Marketing Assn**—Rice Hotel, Houston, Texas, March 2-3.

Southern Safety Conference & Exposition—Atlanta Biltmore Hotel, Atlanta, March 5-7.

National Lighting Exposition—The Coliseum, New York City, March 5-8.

American Society of Mechanical Engineers—Gas Turbine Power Division Conference, Shoreham Hotel, Washington, D. C., March 5-9.

Instrument Society of America—11th Annual ISA Conference on Instrumentation for the Iron and Steel Industry, Roosevelt Hotel, Pittsburgh, March 8-10.

Symposium on Engineering Aspects of Magnetohydrodynamics—Sponsored by AIEE-IAS-IRE-University of Pennsylvania, U of Pa., Philadelphia, March 9-10.

Pennsylvania Electric Association—Residential Committee, Reading, March 13-14; Customer Contact Committee, Monticello, N. Y., March 15; Street and Highway Lighting Committee, Lancaster, March 16-17; Personnel Practices Committee, Pittsburgh, March 23; General and Customer Accounting Committee, Philadelphia, March 23-24.

National Association of Corrosion Engineers—Annual Conference, Statler Hotel, Buffalo, March 13-17.

Edison Electric Institute—Industrial Relations Committee, Mayflower Hotel, Washington, D. C., March 16-17; Meter and Service Committee, Netherland Hilton Hotel, Cincinnati, March 12-15; Sales Conference, Chicago, March 20-21.

• **Tennessee Valley Public Power Association**—Annual Meeting, Hotel Patten, Chattanooga, March 20-22.

• **Canadian Electrical Association**—Western Zone, Empress Hotel, Victoria, B. C., March 20-22.

Institute of Radio Engineers—International Convention, Waldorf Astoria Hotel and Coliseum, New York City, March 20-23.

• **Northwest Public Power Association**—Meter School, Oregon State College Campus, Corvallis, Oreg., March 20-25.

• **American Power Conference** — Sherman Hotel, Chicago, March 21-23.

• **Southeastern Electric Exchange**—Annual Conference, Boca Raton Hotel, Boca Raton, March 27-29.

• **Symposium on Temperature**—Sponsored by American Institute of Physics, Instrument Society of America, National Bureau of Standards, Columbus, March 27-31.

• **Electric Association of Kansas City**—Fifth Biennial Electrical Supply Trade Show, Municipal Auditorium, Kansas City, Mo., March 28-30.

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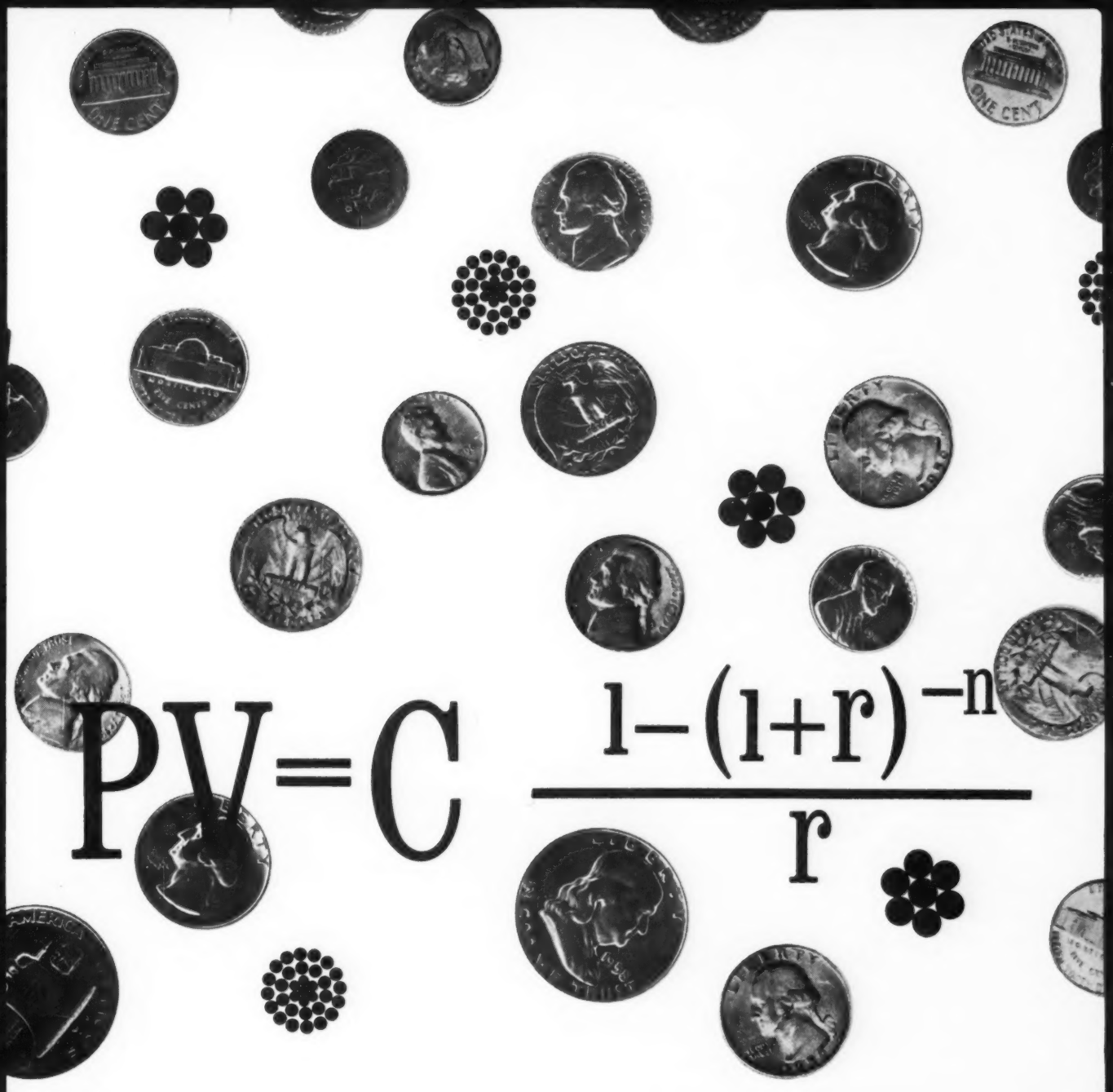

How important is 1% more conductivity?

ALCOA OVERHEAD

It can save you up to $100 per mile of overhead conductor.

Compare two conductors—one with a conductivity of 61%, the other, Alcoa ACSR, with a 62% minimum guaranteed conductivity. Assume all other characteristics are equal. Now you can compute the dollar savings per conductor mile as a result of the extra 1%.

How much dollar savings? You can find the long-range answer, using the formula actuaries use to determine present value (PV) of benefits:

$$PV = C \frac{1-(1+r)^{-n}}{r}$$

where C = annual savings in dollars
n = amortization period in years
r = annual interest rate

You can see how important 1% more conductivity is over the life of a conductor. If you took these savings into consideration at the time of purchase, you could actually afford to spend up to 3 cents per pound more for an overhead conductor with a guaranteed 62% conductivity.

Alcoa gives you this important extra 1%—62% minimum guaranteed conductivity—at no increase in cost.

It's one of many *extras* you get when you use Alcoa ACSR and Alcoa overhead accessories.

Your nearby Alcoa-Rome salesman can help with all your overhead needs. For the name of our nearest representative, write to Rome Cable Division of Alcoa, Dept. 1-21, Rome, N. Y.

ROME CABLE
DIVISION OF **ALCOA**

Double Protection for Pole-Type Transformers

❶ INSULATED "Quick-Grip" TERMINALS ❷ INSULATED "Celuclad" COVERS

Kuhlman pole-type transformers are fully protected by covered high voltage terminals and insulated covers against any possible service interruption caused by wildlife.

The unique protective design of Kuhlman "Quick-Grip" hand connectors prevents outside contact with all live parts. Thus birds and animals cannot short circuit across the two high voltage terminals or cause a line-to-ground short between terminals and the transformer cover. "Quick-Grip" also adds the convenience of simpler, easier line connections without the use of tools.

"CELUCLAD" COVERS ARE ADDITIONAL PROTECTION

As further protection, Kuhlman transformers are equipped with "Celuclad" insulated covers. The extra heavy "Celuclad" coating provides high dielectric strength and greater weather resistance. It is the same heavy-duty, corrosion-resistant finish furnished by Kuhlman for industrial and salt spray atmospheres.

Only Kuhlman offers the double protection of "Quick-Grip" and "Celuclad." Ask your Kuhlman representative about *all* the many extras which are standard on Kuhlman transformers this year.

KUHLMAN TRANSFORMERS

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